MACHINERY

Design—Construction—Operation

Volume 40 **APRIL, 1934** **Number 8**

All factors considered, no industry in the United States has made such spectacular progress in the last twenty-five years as the automobile industry. Vision, initiative, and courage have been its outstanding characteristics. May MACHINERY will deal with the important trends in the application of equipment and materials in the automotive field, showing what is going on in this great industry.

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MACHINERY

Volume 40 NEW YORK, APRIL, 1934 Number 8

From Slugs to Tooth-Paste Tubes

A Remarkable Application of the Extrusion Process

By CHARLES O. HERB

AS you pick up your tube of tooth paste or shaving cream morning after morning, year in and year out, do you ever stop to wonder how this thin metal tube was made? Your fingers have felt these collapsible tubes so often that you know they do not have a lengthwise seam. Were there such a seam, almost anyone could make a guess as to how the tubes were produced.

Any mechanical man who gives collapsible tubes serious thought will conclude that they must be extruded. More than likely, however, he has never had the opportunity of seeing just how they are extruded—of watching the transformation of the small disks or slugs of metal into finished tubes only 0.005 inch thick. This article will describe in detail how the collapsible tubes for Squibb products

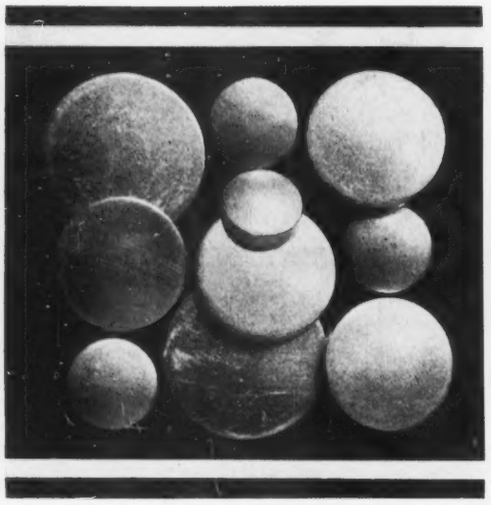


Fig. 1. Metal Slugs that are Transformed into Collapsible Tubes for Tooth Paste

Fig. 2. (Left) Tubes Immediately after Extrusion; (Right) Finished Tubes after Threading, Enameling, and Printing

are made at the plant of the Globe Collapsible Tube Corporation, Brooklyn, N. Y.

Refined tin, 99.87 per cent pure, from the Straits Settlements comes to the plant in pigs weighing from 100 to 110 pounds each. These pigs are melted in gas furnaces, such as are seen in Fig. 3, which are maintained at temperatures ranging from 480 to 500 degrees F. Copper to the extent of one-half of one per cent is added to the molten tin, in order to make the material slightly harder.

The molten tin is poured into cast-iron molds to form slabs or ingots 16 inches long by 4 inches wide by 5/8 inch thick. Thirty molds are mounted at one time on a truck, as shown in the illustration. The molds are inclined so that the molten tin runs down one side of each mold instead of falling immediately to the bottom. This insures the production of ingots that are free from air holes. Two spouts are provided on the furnace in order to enable two molds to be filled at one time.

Fig. 3. Heavy Pigs of Pure Tin are Melted in Gas Furnaces and Cast into Ingots of a Convenient Size for Rolling

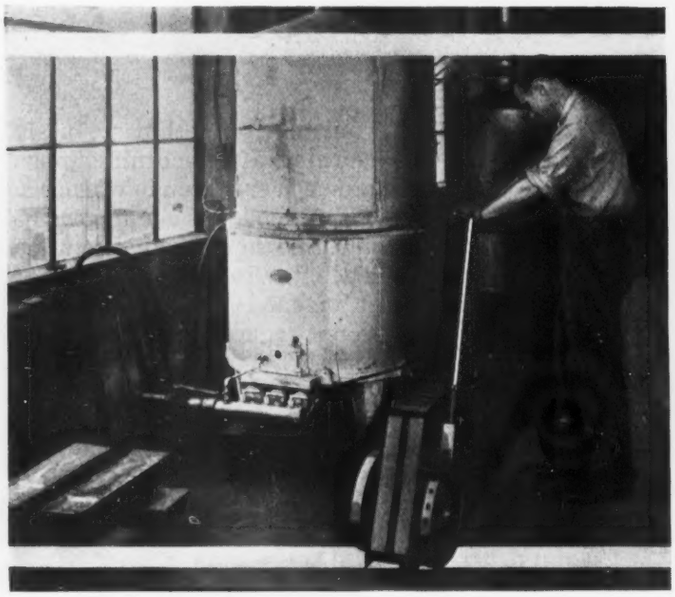
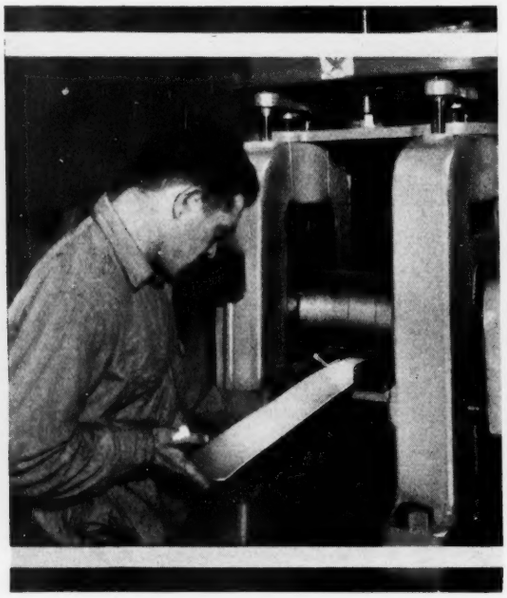


Fig. 4. Rolling a Tin Ingot to the Proper Thickness for Punching into Slugs



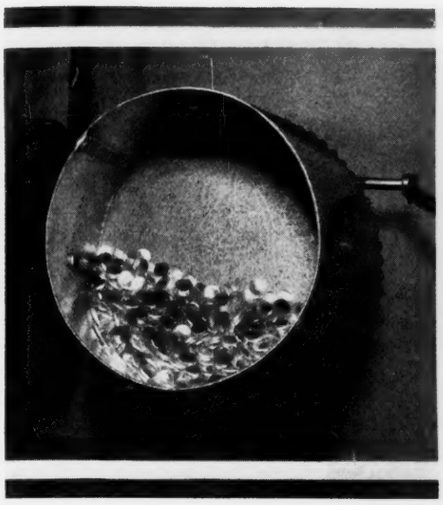


Fig. 5. (Above) The Slugs are Tumbled to Coat Them All over with a Very Thin Film of Mineral Oil

Fig. 6. (Right) The Tubes are Extruded and Ejected into a Chute at the Rate of 44 a Minute

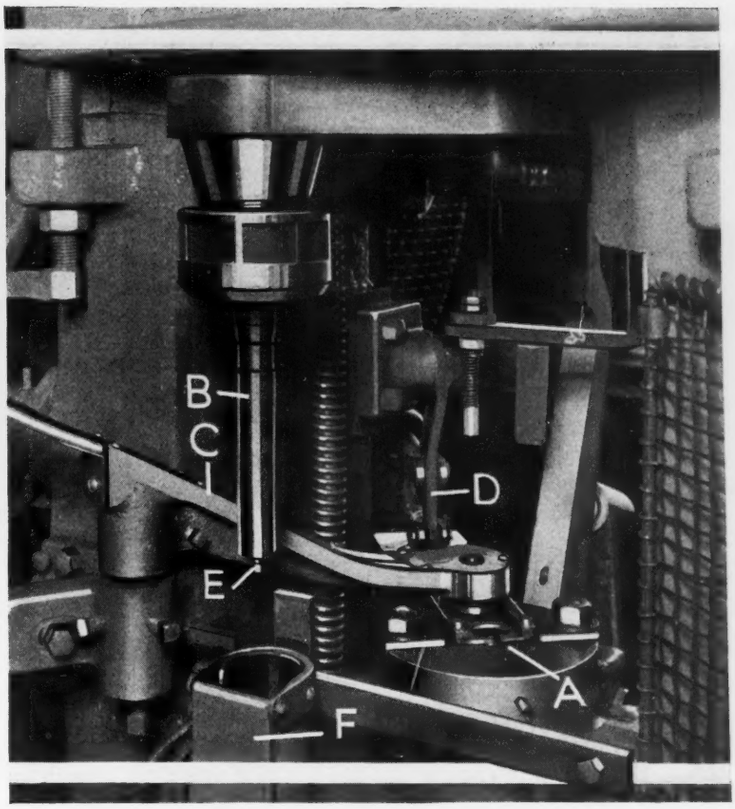
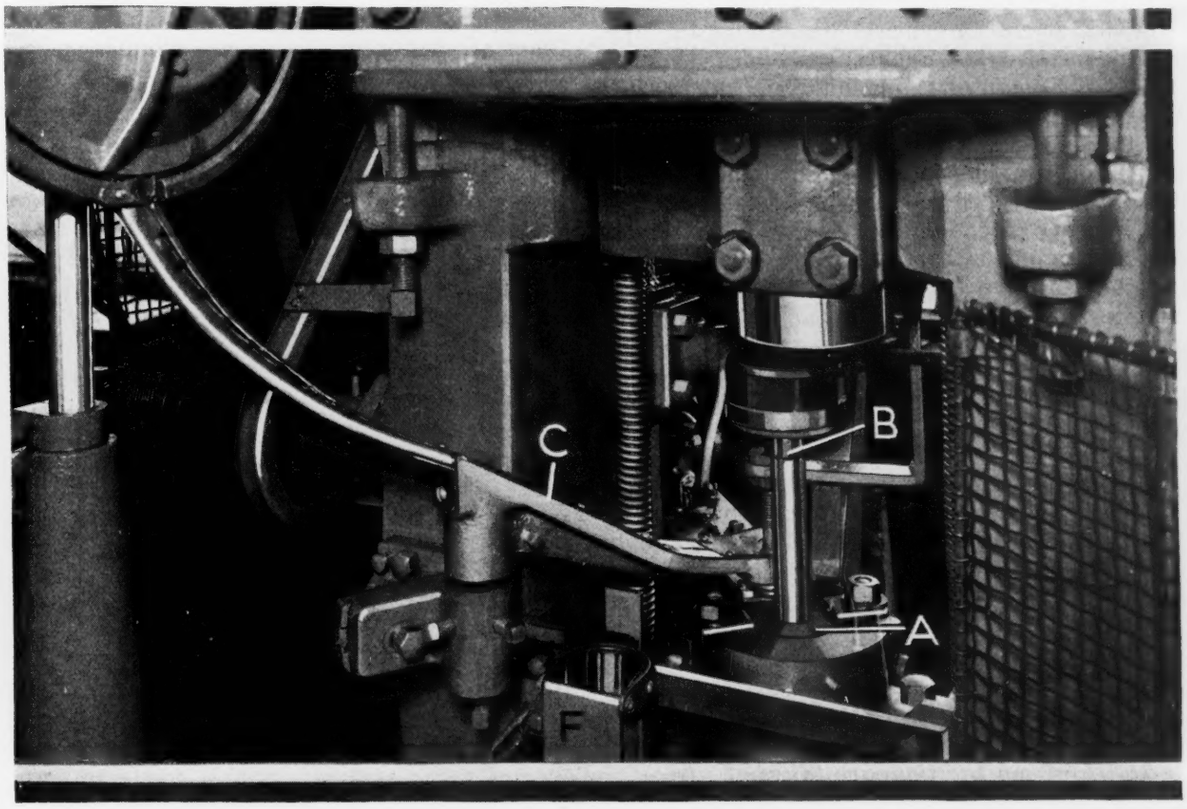


Fig. 7. (Below) The Collapsible Tube Appears as if by Magic when Heavy Pressure is Exerted on the Slug by Punch B



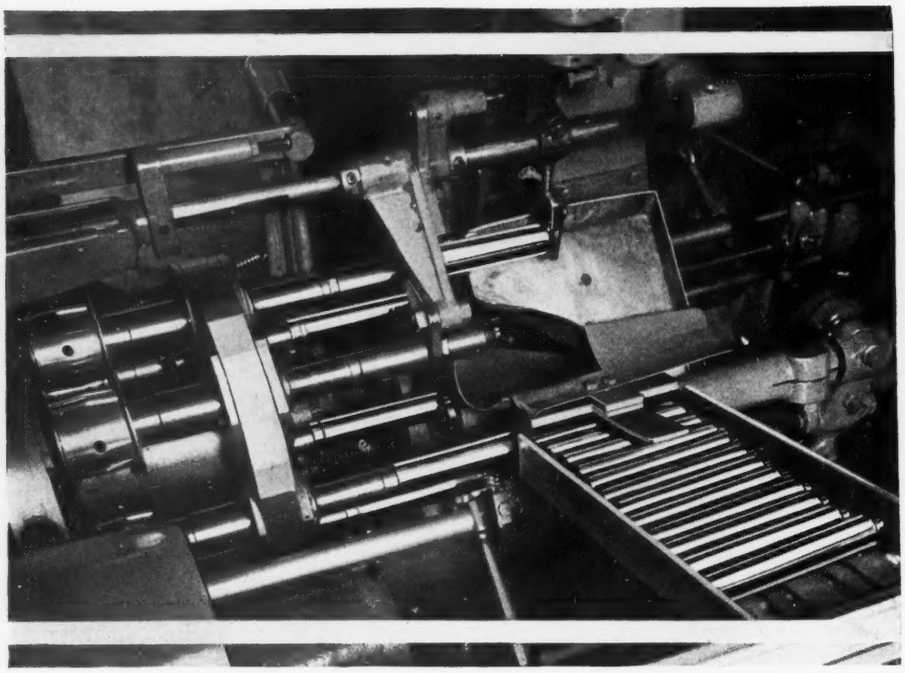


Fig. 9. A Machine that Automatically Trims Both Ends of a Tube, Threads the Neck, and Screws on a Cap

Each tin ingot is reduced in thickness and lengthened correspondingly by passing it between the rolls of the machine shown in Fig. 4. The practice is to run the ingots through in lots of one hundred. After one pass of all pieces, the rolls are adjusted closer together and the entire lot is run through again. This is repeated a third and a fourth time, until the thickness has been reduced to the proper dimension. In this rolling process, the increase in width is negligible, but the length grows to 5 or 6 feet.

The next operation consists of punching the slugs from the metal strips. Each slug is punched slightly concave, the depth of the hollow being about 1/16 inch on the largest slugs shown in Fig. 1, which are 1 1/4 inches in diameter. The diameter of the slugs, like the thickness, depends upon the diameter of the tubes to be extruded from them. The number of slugs punched at one time ranges from two to eleven, according to their size. No scrap results from the punching operation, as the excess stock is returned to the melting room and cast into ingots again.

The Secret of Successful Extrusion Depends Upon an Apparently Minor Step

All of the slugs are tumbled for a minute or so in the barrel shown in Fig. 5, to coat them with a very thin film of oil. For each pail of slugs, only the quantity of mineral oil that can be held in the concavity of one of the slugs is thrown into the barrel. When this oil has been distributed over so many slugs, obviously a minute quantity only can reach each slug, and yet it is upon this trace of oil that successful extrusion to a large measure depends. This point will be explained later.

Tubes Appear as if by Magic

After being taken from the tumbling barrel, the slugs are emptied into the magazines of the extrusion presses. The important tools in the extruding operation are a die *A*, Figs. 6 and 8, and a punch *B*. Slugs are fed to the die through chute *C* and a slide

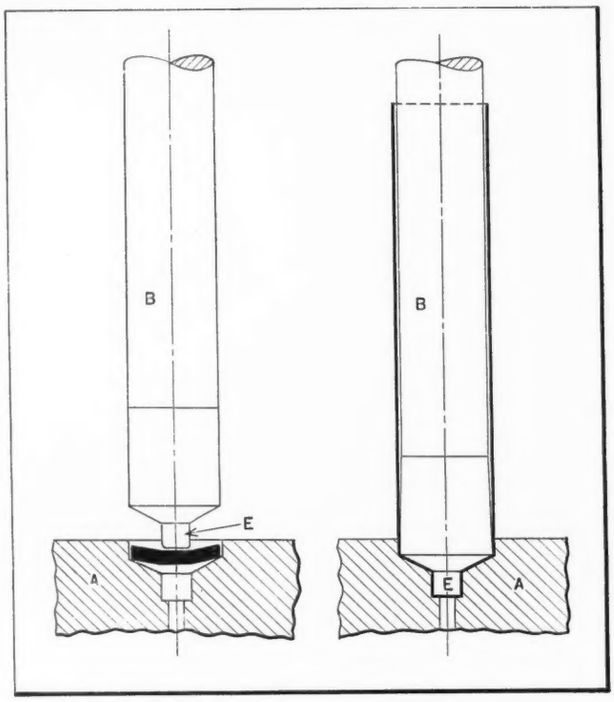


Fig. 8. Diagrams that Show How Collapsible Tubes are Extruded from the Concave Slugs

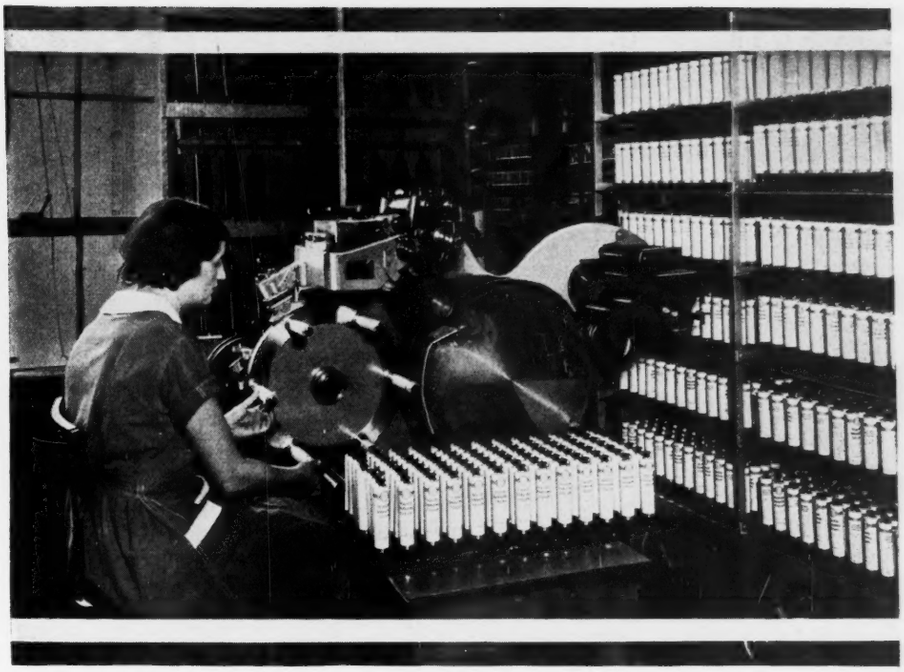


Fig. 10. Printing the Name of the Product, Trademark, Directions and Other Information on the Tubes

operated by lever *D*. The slugs are placed in the die with the concave side upward.

Punch *B* is attached to a swinging arm that carries the punch from directly above the center of the die, as shown in Fig. 7, to the work ejecting position illustrated in Fig. 6. When the punch is vertically in line with the die center, a downward stroke of the machine ram causes the punch to exert a tremendous pressure on the slug in the die. The punch is 0.010 inch less in diameter at the lower end than the die hole, leaving a space 0.005 inch wide between the punch and the die all around, through which the highly compressed tin can escape.

Through this opening rises a tube of smooth, bright metal, only slightly longer than necessary for an individual tube of tooth paste or shaving cream. The operation is fascinating, because the metal advances up around the punch so rapidly as to give the impression of being flowing mercury. Fig. 8 illustrates diagrammatically how the operation is performed. In the left-hand view the slug is indicated in solid black, lying in the die, while in the right-hand view, the extruded tube is indicated by the heavy lines.

The lower end of the punch is a plug of hardened high-speed steel, about 1 1/8 inches long, which is screwed to the punch shank. This plug is ground to a slight back taper (shown exaggerated in Fig. 8), so that as the tube comes through the space between the punch and die, friction from the punch ceases almost instantly. Wear occurs, of course, on the lower end of the punch plug, but because of the construction employed, a plug can be replaced at minimum expense when worn out.

The nomenclature "E. R. Squibb & Sons, New York," is pressed into the shoulder of the closed tube end by punch *B*, and the neck is formed (but not the thread) by a separate piece *E*, which has a slight vertical movement in relation to the punch proper.

The instant that the tube is completed, the punch rises about 4 inches with the press ram, and at the same time, swings about 85 degrees into the position shown in Fig. 6. An ejector insures the removal of each tube from the die when the punch ascends. When the position shown in Fig. 6 is reached, a blast of compressed air is released through a hole in the punch to act on piece *E*. This pressure instantly forces the tube from the punch and into chute *F*, which leads to a narrow belt conveyor. If a tube should adhere to the punch upon its return to the die, the tube would strike a bar, completing an electric circuit that would operate a solenoid to stop the machine before damage could result.

Tubes are extruded at the rate of 44 per minute. The machine illustrated is set up for producing tubes 1 1/16 inches in diameter by 5 3/16 inches long. Approximately one gross of tubes of this size is obtained from one of the original ingots of tin.

Reference has been made to the importance of the oil tumbling operation. If the slugs are fed to the extruding die without having first been given the slight oil film mentioned, the tubes crumble and tear while they are being formed. The oil provides sufficient lubrication to make the tin slide over the punch edge with minimum friction. From 50 to 100 tons pressure is employed in the extruding operation.

Getting the Tubes Ready for Filling

The conveyor which picks up the tubes at each extruding press conveys them to a multiple-spindle machine, such as illustrated in Fig. 9. Here they

are automatically trimmed to length at both ends, a thread is rolled for the phenolic-molded cap, and the cap is screwed on. As the tubes leave the machine, they slide down a chute to a girl who packs them in paper boxes.

The shaping of the tubes has now been completed, but they must still be enameled and baked before they are ready to be filled. White enamel is rolled around the tubes on machines of the type shown in the heading illustration. The enamel is carried to the tubes from a reservoir in the proper amount by one steel and two rubber rolls. As the tube reaches the front rubber roll, it is revolved momentarily by the roll so that the enamel is carried all around.

The enameled tubes are placed on wire racks, one of which is shown in the foreground of the illustration. These racks hold from 100 to 144 tubes, depending on their size. The racks are placed on trucks that hold twenty-four racks each. The loaded trucks are then automatically pulled through a long baking oven, the temperature of which is kept at 225 degrees F. by steam. Blowers circulate the hot air through the oven. It takes thirty minutes for a truck to pass through the oven, and when it emerges at the other end, the enamel has been completely baked.

From the baking oven, the tubes are taken to printing machines, of the type shown in Fig. 10, where the name of the product, the address of the manufacturer, trademark, etc., are printed on by the offset process. In the operation shown, black and bronze inks are being used. The black ink is transferred to a plate and then to a rubber pad on the revolving drum, from a reservoir and rubber rolls at the right-hand end of the machine, while the bronze ink is transferred to the rubber pad from a reservoir, rubber rolls and plate at the left-hand end of the machine. The same machine can be arranged for three-color printing if desired. In both the enameling and printing operations, a girl can handle about fifteen gross of tubes an hour—thirty-six tubes a minute.

The racks of printed tubes are returned to the truck, which is drawn through the baking oven again by a second conveyor that runs in the opposite direction to the first. When the truck leaves the oven, the dried tubes are boxed and placed on a conveyor that carries them to the filling department. Here the tubes are loaded on a machine that fills them, four at a time, with tooth paste or shaving cream and automatically seals the open ends.

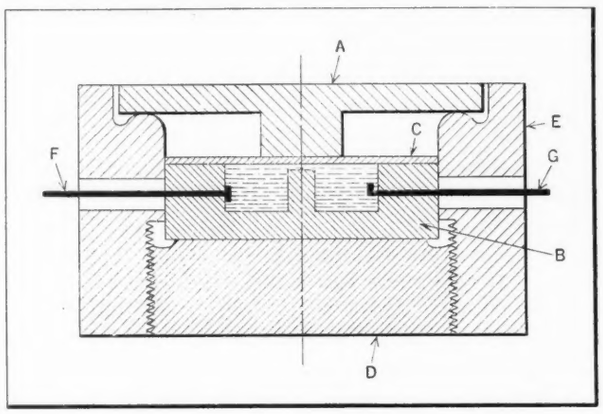
* * *

We are witnessing a revolution in politics, industry, agriculture, and, indeed, thinking. It is our hope that the measures now being applied will furnish the bridge over which we can cross the chasm of destruction, and that on the other end of that bridge we will find familiar, normal footing.—*P. W. Litchfield, President, The Goodyear Tire & Rubber Co., in the Executives Service Bulletin*

Cutting Pressure on Tool Measured by Electrical Resistance

An interesting method of measuring the pressure on the cutting edge of a tool has been developed by Schiess-Defries, Germany. The essential parts of the apparatus, as described in *Engineering*, are shown in the accompanying illustration. The toolholder is so constructed that the pressure is transmitted to the stiff steel plate *A*. This plate has a boss on its under side, with the lower face a short distance above the top of a pin in the center of a non-conducting vessel *B* filled with a suitable electrolyte. The top of the cavity containing the electrolyte is covered by a sheet of rubber *C*. The distance between the under side of the boss and the top of the pin in the electrolyte chamber *B* can be adjusted by raising or lowering the plug *D*, which is screwed into the bottom of the casing *E*.

Electrodes *F* and *G* project into the electrolyte at each side, as illustrated. As the plate *A* is in the



Tool Support that Varies Resistance of Electrical Circuit to Correspond with Cutting Pressure

form of a very stiff beam suspended at each end, the pressure on the tool will cause the plate to be deflected slightly, the actual deflection varying with the pressure. When deflection occurs, the distance between the under side of the boss and the top of the pin will be reduced, thus changing the cross-sectional area of the electrolyte at this point and, therefore, its resistance.

This variation is recorded on an ammeter in the electrode circuit, thus giving a determination of the pressure on the tool. The ammeter readings for different pressures are recorded so that the apparatus can be used on any standard machine. The actual deflection of the steel plate is very slight, and the tool is practically rigid. Thus the cutting efficiency of the tool is not affected by the mounting.

* * *

According to the *Economic Review of the Soviet Union*, there are now 110 blast furnaces blown in, in the Soviet Republics.

Protecting Motors Against Overheating

The Causes of Excessive Motor Temperatures, and How They Can Be Guarded Against

By O. G. RUTEMILLER, Machine Tool Engineer
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

THE power requirements of practically all machine tools are intermittent. This is due to the fact that the load on the motor is greatly reduced when the finished work is being removed from the machine and a new piece inserted. Because of this characteristic, most machine tools are provided with intermittently rated motors—that is, with motors that are capable of carrying their full rated load for one hour or less without exceeding a safe temperature rise. These motors will carry overloads for short periods of time.

With the advent of tungsten- and tantalum-carbide cutting tools, power requirements have increased, resulting in a condition where many machine tool motors are overloaded. Furthermore, the constant demand of machine tool users for a lower ratio of idle time to cutting time has led machine tool designers to develop machines that can be loaded and unloaded much more quickly than in the past. This has also increased the average load on the driving motor.

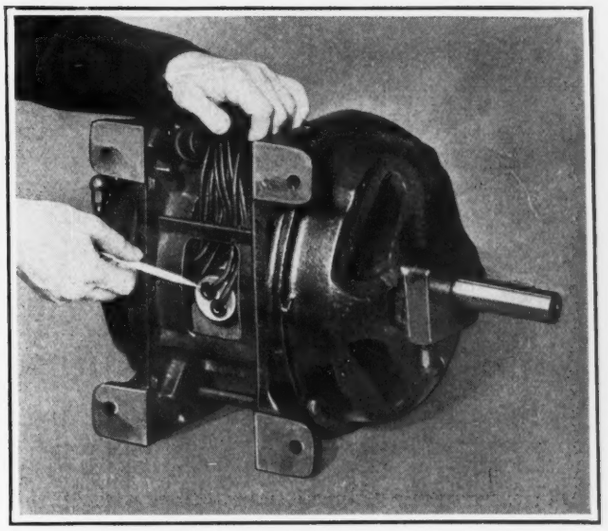
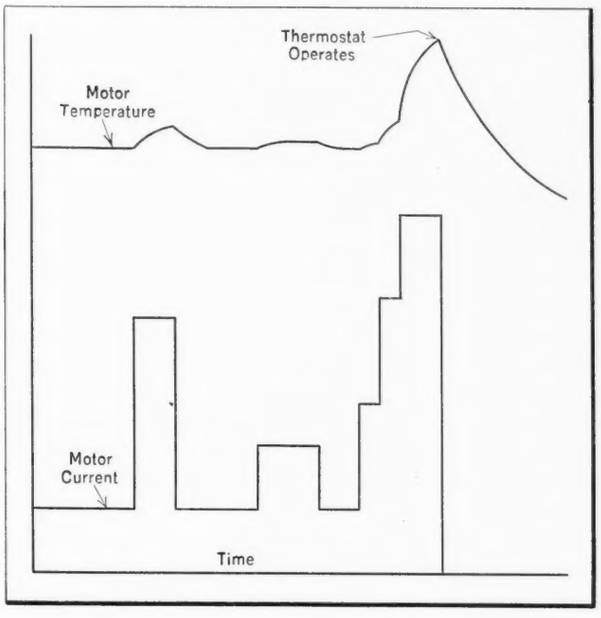


Fig. 1. Motor Equipped with a Thermostat that Operates with or without a Thermal Overload Relay

By overloading a motor and causing it to become overheated, there is danger of deteriorating the motor insulation and finally causing motor failure. When the motor rating is close to the maximum requirement of the machine, the most general cause of overloading is dull tools.

Fig. 2. Curves Showing how the Current Consumption and Motor Temperature Vary in Taking Different Cuts in a Machine Tool



How Repeated Overloads May Affect Motors

The effect of repeated overloads is accumulative unless the motor has time to cool down to its normal temperature between the overloads. Fig. 2 represents a condition in which there is a load of intermittent nature, such as might be encountered in running a tool-room lathe when a number of different operations are being performed. The bottom diagram shows the variation in power consumption while taking the different cuts, and the upper curve shows the changes in motor temperature corresponding to the various operations, or the differences in loading.

It may be seen that the motor temperature does not increase much above the room temperature on slight overloads, and when the load decreases for a sufficient length of time the motor temperature returns to the room temperature. However, if the operator takes too heavy a cut or if the tools become dull, the motor temperature will increase rapidly, due to the load increase.

The curves in Fig. 3 represent the conditions when a machine operates in regular cycles, as, for example, a gear-hobbing machine, an automatic

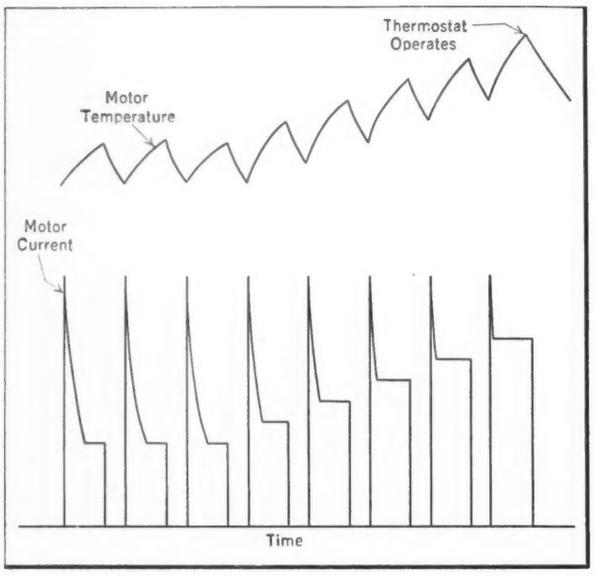


Fig. 3. In the Operation of an Automatic Machine, the Motor Temperature will Rise Greatly as the Tools Become Dull

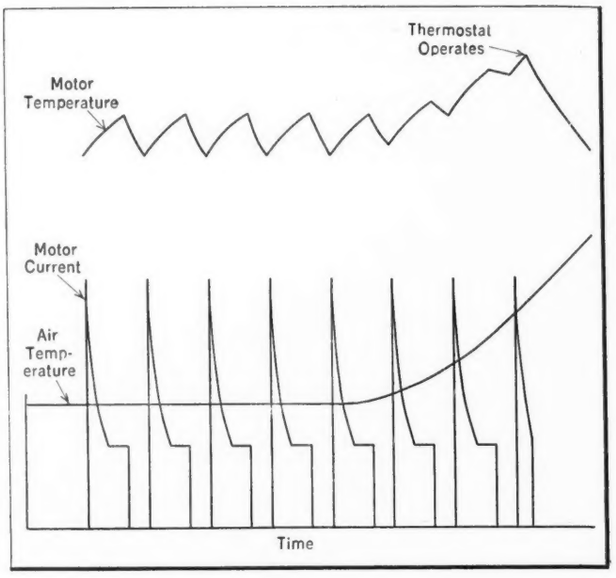


Fig. 4. An Increase in Room Temperature May Cause Overheating of a Motor even when Running at Normal Load

screw machine, or an automatic milling machine. The motor temperature rises each time that the motor is loaded, and it returns to the room temperature during each idle period, provided the load remains the same. However, as the tools become dull, the motor load increases, and since the time of the cycle remains constant, the load is greater during each cycle. If the motor does not have sufficient time between cycles to cool down, it will soon reach an unsafe temperature. Fig. 4 shows how an increase in room temperature will bring on excessive motor temperature.

The Use of Overload Protection Devices

The protection of a motor against overloads is always an important problem because a burned-out motor represents a loss in production.

Overload relays are of two general types, dashpot time-delay and thermal time-delay. The dashpot, by mechanically retarding the action of the contacts, allows the motor to take short-time overloads. If an overload lasts for a sufficient length of time, the relay trips. However, this type of relay resets or returns to the starting position as soon as the overload ceases, and if the overload occurs again before the motor has cooled to room temperature, the dashpot allows the same length of time to elapse before the relay trips again. Consequently, there is an accumulation of heat in the motor. The latter may finally burn out without tripping of the relay.

The thermal type of overload relay helps to eliminate the undesirable condition just described, its operation depending upon the heating of a thermal element which, more or less, follows the heating curve of the motor. Various thermal elements are used for different sizes of motors. The thermal relay protects against ordinary overloads, but it does not guard against such conditions as too frequent starting, repetitive overloads, and failure of ventilation. In some applications, such as punch presses, an over-size relay may be used merely to allow for starting, at the expense of protection. It will be obvious that the overload relays commonly used guard against ordinary overloads, but they do not give adequate protection under abnormal conditions.

Thermostats for Motor Protection

A recent development that protects motors from high temperatures, regardless of the cause, is a thermostat which is attached directly to the motor, for use without a conventional thermal overload relay or in conjunction with it. This thermostat opens its contacts when the motor temperature exceeds a certain safe limit. The safe limit may be well below the point at which the insulation of the motor is affected by the heat.

The thermostat contacts may be arranged to disconnect the motor from the power line or to operate a warning signal, such as a light or a bell. If the operator is given a warning signal, production need not be interrupted. However, on fully automatic equipment where the operator tends to several machines, it is probably better practice to stop the machine. The thermostat guards against conditions that cannot be covered by other types of overload protection, as, for example, when the temperature of the surrounding air rises sufficiently to make the motor temperature unsafe even when running with a normal load.

The New Cast Irons and Their Treatment*

THE art of casting metal parts has progressed rapidly in recent years. The day is now at hand when the engineer will specify the proper ingredients and the necessary heat-treatment for cast metal parts, whether ferrous or nonferrous, to secure the desired physical characteristics. Many engineers, however, are not yet aware of the fact that cast metals respond to such heat-treatments as hardening, annealing, nitriding, carburizing, and normalizing. Castings can now be obtained for exacting requirements—high strength, corrosion and heat resistance, hardness, wear resistance, and shock resistance.

The gray iron cast to specifications today must not be classed with that of yesterday. Instead of the doubtful 20,000-pound tensile strength attributed to the older castings, the castings now obtainable may have a definite tensile strength ranging from 20,000 to 60,000 pounds per square inch, without resorting to heat-treatment. Cast malleable parts are now being made with a tensile strength up to 120,000 pounds per square inch.

The 20,000-pound type of cast iron is suitable only for low-duty service. The American Society for Testing Materials and the American Foundrymen's Association have prepared specifications covering iron castings ranging in tensile strength from 20,000 to 60,000 pounds per square inch. The strength is affected very little by the thickness. High-duty iron castings have endurance ratios up to 50 per cent of their tensile strength.

Heat-Treatment of Cast Iron

Cast iron reacts to heat-treatment in a way comparable to steel. It can be annealed, hardened, carburized, or nitrided with the equipment used for treating rolled or forged steel parts. When cast iron is annealed to relieve internal stresses, the process is called "normalizing" or "aging." The part is heated to from 800 to 950 degrees F. and held at this temperature for from one-half hour to five hours, depending on the thickness. It is then cooled slowly in a furnace. This process reduces the hardness with slight loss in strength.

Non-alloy castings are annealed to make them more readily machineable by heating them to from 1200 to 1500 degrees F. Alloy castings are heated to as high a temperature as 1800 degrees F. The strength of the casting is reduced and its hardness may be as low as 130 Brinell.

Cast-iron parts are hardened to increase their strength, wearing qualities, impact and abrasion resistance, to reduce the permanent set as much as one-third of its original value, and to bring the stress-strain diagram close to that of steel.

Quenching cast-iron parts of the high-duty class above 1350 degrees F. and up to 1500 degrees F. increases their hardness up to 600 Brinell, in direct relation to the rapidity of cooling. High-duty cast-iron parts may be defined as a pearlitic iron with well distributed small-flake carbon. Parts not requiring high strength may be quenched at 350 degrees F. and up. If high strength and impact resistance are required, the castings should be quenched and drawn.

The nickel-chromium alloy irons are air-hardening, while the non-alloy irons are quenched in baths such as are used for steel treating. Cast iron does not crack or warp more than steel. Complicated castings should be air-hardened. All rough machining operations are performed before hardening; the castings are then finished by grinding.

The wear resistance of iron castings is increased by nitriding in contact with anhydrous ammonia gas at a temperature of 1000 degrees for from one to one and one-half hours. The irons found to be most suitable for this treatment are those alloyed with chromium-aluminum or chromium-vanadium. Cast-iron parts can also be hardened by the nitrogen process.

The heat-treatments referred to make it feasible to use iron castings for such parts as forging dies; forming dies; gears; cylinder liners for compressors, engines, and pumps; crankshafts for powerful Diesel engines and high-speed automobile engines; camshafts; and wearing plates on high-grade machines.

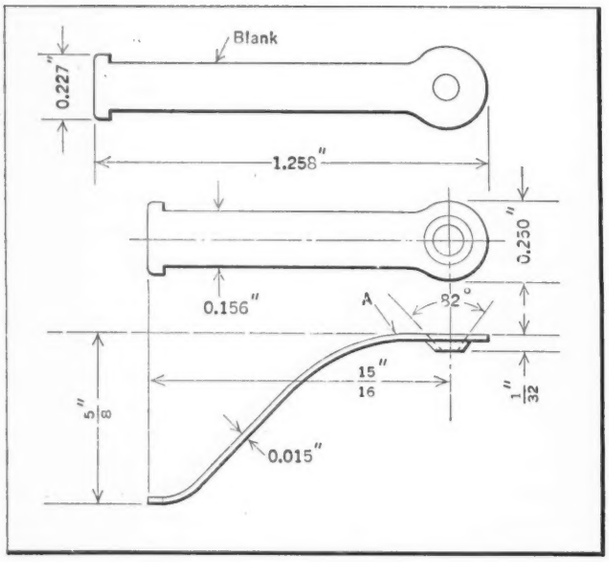
Characteristics of Modern Alloy Cast Irons

The properties or characteristics of some of the modern alloy cast irons and their identifying trade names are as follows: *Ni-Resist*—A nickel-chromium iron containing up to 14 per cent nickel and 5 1/2 per cent chromium. This does not grow or scale at temperatures up to 1500 degrees F. and resists acids and alkalis. *Meehanite*—A specially treated cast iron with calcium silicide to give the necessary silicon range with a low-carbon mix. *Duriron* and *Pyrocast*—A high-chromium cast iron having the quality of corrosion resistance. *Ni-Hard*—Iron possessing an exceptionally hard surface (up to 625 Brinell). *Sial*—An iron applicable where high temperature is encountered.

*Abstract of a paper read before the American Society of Tool Engineers by Harry M. Dietert, chief engineer of the United States Radiator Co. and president of the H. W. Dietert Co.

Determining Hardening and Tempering Temperatures for Springs

By E. BELL HARE



Spring Subjected to Wide Range of Hardening and Tempering Temperatures to Determine Proper Heat-treatment

THE method of hardening and tempering test springs like the one shown in the accompanying illustration, to determine the treatment necessary in order to obtain the desired results, may be applied to advantage in determining the heat-treatment required for other springs. The spring illustrated is made in large quantities from steel 0.015 inch thick, 5/32 inch wide, and 1 1/4 inches long, containing 0.85 to 0.90 carbon and 0.38 to 0.40 manganese. This spring is held in position by a screw at one end, while the other end is located on the part it actuates. The required deflection is 9/16 inch after the initial spring-back or set, and it requires a load of 2 1/4 pounds to depress the spring 9/16 inch. Theoretically, the load placed on this spring appears to be too heavy from the viewpoint of durability.

With the first springs tested, breaks often occurred at point *A*. This seemed to confirm the theory that the load was too great. The Rockwell hardness test was found to provide the most satisfactory means of determining the hardness of the finished springs and it is used regularly to maintain uniformity of the product in this respect. The hardness range in the case of this spring is maintained between 47 and 48 Rockwell. Springs of this kind should be heated for hardening in salt baths having a temperature of approximately 1425 to 1450 degrees F., and quenched in oil, after which they should be drawn from 550 to 600 degrees F. The latter temperature is generally preferable, depending on the amount of stress imposed on the spring. The spring should be kept immersed in the tempering oil from fifteen to twenty minutes. Any shorter period than this is likely to result in failure. Springs should be over-formed to allow for the inevitable spring-back or initial set.

The temperature at which the spring is drawn is determined by the duty it is to perform. The results of a test recorded in the accompanying table assisted in determining the drawing temperature of the spring under consideration.

These springs took their initial set, and when subjected to the maximum deflection for long periods, their recovery was very satisfactory. The lowest temperature at which the steel in these springs hardens will give the minimum grain size. A temperature of 1425 degrees F. is the minimum

Results of a Test on Flat Springs Hardened and Tempered at Different Temperatures and Finished by Plating

Table Giving Results Obtained with Spring Shown in Illustration when Hardened at 1450 Degrees F. and Drawn at Different Temperatures

Temperature of Tempering Bath, Degrees F.	Number of Springs That Broke	Number of Springs That Passed Tests Satisfactorily
Spring 0.015 Inch Thick Immersed in Tempering Oil for 15 Minutes		
480	21	19
550	10	30
575	0	40
Spring 0.014 Inch Thick Immersed in Tempering Oil for 15 Minutes		
480	18	22
550	0	40
575	0	40

Before plating, a load of 1 pound 10 ounces was required to depress spring ½ inch.

After plating, a load of 2 pounds 1 ounce was required to depress spring ½ inch.

After oil treatment, a load of 1 pound 12 ounces was required to depress spring ½ inch.

limit at which this steel can be satisfactorily hardened. This temperature gives a small granular structure which greatly increases the toughness.

When hardened but not drawn, this steel gives the following results, breaking at the deflections indicated:

Hardening Temperature, Degrees F.	Deflection, Inch
1425	1/8
1375	7/16
1350	9/16

A spring of this nature deflecting 9/16 inch before being drawn is obviously too soft. The lower temperature experiments were merely part of the investigation made to determine the proper heating and drawing temperatures. Any part of a spring that is struck or pinched while it is being formed becomes a potential point of breakage, as the resulting strains and structural changes are not relieved by the heat applied in tempering. The introduction of manganese is a disturbing factor as regards grain structure. The hardening temperature must be increased as the percentage of manganese increases.

Frequently, it becomes necessary to plate a spring to protect it against corrosion or rusting. When this is required in the case of the spring shown in the illustration, cadmium is used as the plating material. In plating springs, a violent change takes place in the molecular structure of the material. Springs that did not break under the maximum load tests before being plated have failed with only half the load after being plated. This breaking of the springs was due to hydrogenating, which means that a minute film is formed between the molecules which tends to separate them.

Therefore, it is necessary to subject the springs to a temperature ranging from 200 to 400 degrees F., in order to dehydrogenate them and remove all defects caused by the plating process. The length of time the springs should be heated depends on the temperature. At 400 degrees, one hour is satisfactory, but at 200 degrees, we have found twenty-four hours to give the best results.

* * *

Variable-Voltage Adjustor

A "variable-voltage adjustor" has been developed by the Acme Electric & Mfg. Co., Cleveland, Ohio, which permits the regulation and adjustment of the primary-line voltage from either below or above normal, to the proper operating voltage of an electrical product. This variable-voltage adjustor is especially intended for radio use, but can be applied to many other services where electrical products are used that require a closely controlled voltage. In localities supplied with power from a generating plant not thoroughly controlled with a voltage regulator, fluctuations in voltage often create difficulties in the use of radios, small motors, etc.

Ideals of Engineering Education

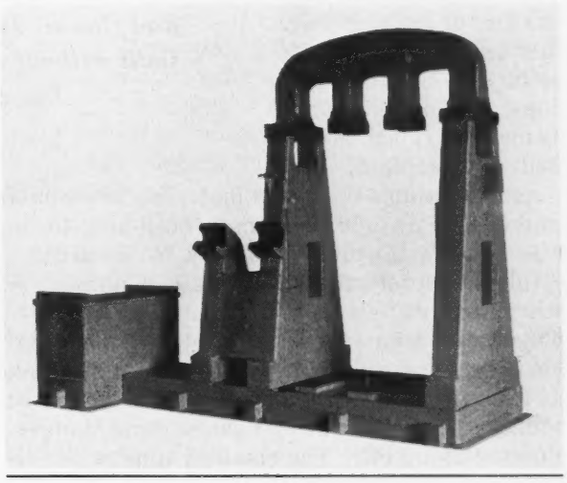
Aside from preparation for a career, engineering education is the modern type of general liberal education, acquainting the learner, as it does, with the processes, devices, and methods which make our civilization distinctive. Cultured people are those who understand their environment—the world in which they live—and no type of education so directly assists the individual to understand his surroundings as engineering education, which familiarizes one with the machines and the techniques of the modern world. So we of the engineering profession, as well as the public at large, are interested in making engineering education more effective as a preparation for happy living. As Herbert Spencer stated, "To prepare us for complete living is the function which education has to discharge."

Some of the graduates of engineering colleges should be given encouragement to continue their preparation for engineering as a career, but a much larger number should be assisted in entering non-engineering vocations with engineering education and possibly even with some engineering practice as a foundation. There is a definite need for a clear-thinking and fact-finding technique in professional, economic, business, and political fields. —*A. A. Potter, Dean of Engineering, Purdue University, and Past-President of the American Society of Mechanical Engineers.*

* * *

According to *Engineering*, in 1933, Great Britain led in the launching of merchant vessels of 100 tons and over, Japan coming second, followed by Sweden, Germany, Holland, France, and Denmark in the order mentioned.

Frame for a Large Vertical Triplex Pump of Welded Construction Built by William B. Pollock Co. The Frame is 10 Feet High by 12 Feet Long



Tubes Can be Bent Like Solid Bars

In the Method Here Described, a Metal of Low Melting Point is Used to Reinforce the Tube on the Inside During the Bending Operation

THE bending of thin-walled tubes to small or medium radii has always been a difficult problem, because of the tendency of the wall to buckle, flatten, or rupture. Rosin, tar, sand, lead, and other materials have been used in the past to support the tube from the inside during bending, and these materials successfully prevented buckling of the wall, unless the bends were very severe.

One objection to the use of such materials, however, is that, in cleaning out the tube after it has been bent, the user can never be sure that particles of the filler are not lodged around a bend, ready to loosen and perhaps cause trouble when the tube is placed in service. Difficulty is also experienced in packing sand solidly enough to entirely prevent buckling, especially in tubes of small diameter. Lead filling of tubes produces satisfactory bends, but the comparatively high melting point of lead often has a deleterious effect on the physical properties of the tube.

The Cerro de Pasco Copper Corporation, 44 Wall St., New York City, is marketing an alloy having a melting point of only 160 degrees F.—considerably less than the temperature of boiling water—for use as a filler material in tube-bending operations. "Bendalloy," as this metal is called, is composed of bismuth, lead, tin, and cadmium. With this material, tubes having a wall as thin as 0.007 inch have been bent to small radii. The metal filler conforms to the inside of the tube so closely that the tube can be bent just as though it were a solid rod.

This method has been applied to the bending of copper, brass, duralumin, plain steel, and stainless steel tubes with uniform success. Tubes plated with chromium or nickel can be bent without danger of the plate flaking off. The smallest tube so far bent was 1/8 inch in inside diameter. The practice usually is economical for tubes up to 2 inches in diameter. For larger sizes, the cost of the metal filler would probably be too high on an average job.

The method is considered ideal when the number of tubes of a given size or kind is more or less limited or when the bend is especially severe. It is not expected that it will be employed when the quantity of tubes of a given type is large, as in the manufacture of electrical refrigerators. Under such conditions, special machines that retain proper tube section by means of a moving chain of links shaped to suit the operation would be warranted.

Fig. 1. These Thin-walled Copper and Brass Tubes were Bent into Coils without Buckling, through the Use of Bendalloy

When a tube is to be bent, one end is closed tightly by means of a cork, rubber, or other suitable stopper. Sufficient Bendalloy for the job is then placed in a clean ladle or similar vessel and covered with water. The water is next heated to the boiling point, which completely melts the Bendalloy.

The tube is now filled to the top with the boiling water, in order to preheat it. This step guards against cold sets in the filler when it solidifies. The molten Bendalloy is poured into the tube while it still contains the boiling water, thus displacing the water with the metal. After the tube has been filled with Bendalloy, it is quickly chilled by immersing it in a tank of cold water or by directing a stream of water against it. Chilling should be started at the closed end and carried on gradually toward the open end.

The chilling is necessary in order to develop a fine crystal structure in the solid Bendalloy that will resist cracking when the tube is bent. Progressive chilling is essential to prevent the formation of shrinkage cavities. Such cavities are likely to cause failure, especially if the tube is of small

diameter. Bending is not attempted until the filler tube has reached room temperature.

When the tube is of too small a diameter to permit pouring of the molten metal, the metal can be easily drawn into it by suction. This practice is generally followed with tubes 1/4 inch in diameter or less.

Practically any form of bending equipment can be used for shaping the tube, provided the bends are produced slowly, at uniform speed, and with a constant load. Too high a speed or uneven application of power sometimes causes failure. In the case of thin-walled aluminum or duralumin tubing bent to a small radius, the bending should be performed in multiple stages rather than all at one time.

When a tube-bending operation has been completed, the removal of the metal filler is a simple process. The tube need merely be heated in steam, in a bath of boiling water, or in air of about the same temperature. The metal can then be drained out and used again and again.

Fig. 2. Another Typical Example of Tubes Bent by this Method—These Tubes Have a Wall Thickness of Only 0.013 Inch

"Tinning" of tubes on the inside by the filler metal does not occur, except under unusual conditions. It can be avoided by dipping the tube in engine oil before the molten metal is poured into it.

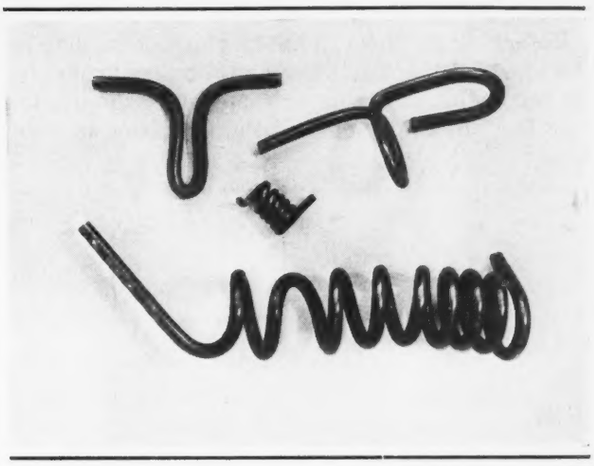
The illustrations show a number of difficult bending examples performed by the use of this metal filler. At the upper right in Fig. 1 is shown a rectangular coil made from copper tubing, 1/2 inch outside diameter, having a wall thickness of only 0.013 inch. Even with such a thin wall, it was possible to bend this tubing successfully to a radius of 7/8 inch. The coil in the center of the illustration is made of brass tubing, 5/16 inch outside diameter, with a wall thickness of 0.02 inch. This tubing was bent to a radius of 3/4 inch. The example shown at the bottom of the illustration is copper tubing, 1/2 inch outside diameter, having a wall thickness of 0.031 inch. This piece was bent around a broom handle.

Fig. 2 shows two copper tubes having an inside diameter of 3/4 and 1 inch, respectively, and a wall thickness of 0.013 inch. One of these tubes has been bent to an outside coil diameter of 6 inches, and the other to 6 1/2 inches.

In Fig. 3 the upper right-hand tube was rolled flat after it had been filled with Bendalloy. It was then bent as shown. The small tube in the center of the illustration is made of brass. It has an inside diameter of 1/8 inch, a wall thickness of 0.009 inch, and was bent to an inside coil diameter of 1/2 inch. The brass tube at the bottom is 3/8 inch inside diameter, has a wall thickness of 0.018 inch, and is bent to an inside coil diameter of 1 inch.

This method of bending tubes has found special favor in airplane factories, as it affords a convenient means of shaping oil and gasoline lines to meet individual needs. The knowledge that tubes used for these purposes are free from foreign substances is also a distinct advantage here. Tubes used in constructing airplane frames are also formed by the use of Bendalloy. One example is a tube of molybdenum steel with a stream-lined cross-section. Tubes of irregular cross-section can be bent as readily as round tubes.

Fig. 3. Tubes Successfully Bent to Small Radii by Pouring Molten Metal into Them and Allowing it to Solidify before Bending



Tubes may be bent by this method fully as readily in the field as in the shop. Plumbers, for instance, have found it a convenient means of producing coils for replacement purposes in hot water heaters. There are many hot water heaters on the market of various makes, most of them with coils of different dimensions, so that when repairs are necessary a special coil usually has to be made.

Tubing filled with Bendalloy can be rolled, drawn, or swaged in addition to being bent. They can also be cold-pressed or forged to desired shapes.

Automatic Machine for Forming Elbows from Tubing

By J. E. FENNO

THIRTY-SIX hundred elbows an hour are formed from seamless brass tubing in the machine shown in Figs. 1 and 2. The elbows are part of a popular household labor-saving device and were formerly cast, at a relatively higher cost. A zigzag magazine is provided on this machine for feeding the pieces of tubing to the bending rolls. This arrangement enables the operator to attend to several machines, as they are entirely automatic. A feature worthy of note is that the zigzag magazine permits an even flow of tubes without jamming. The feeding mechanism also serves as the ejector. Also, the tubes are fed into position by a spring-actuated slide which permits a higher operating speed than could be obtained with a mechanically operated slide.

Referring to Figs. 1 and 2, which show side and end views of the machine, the tubes are loaded into the top of the magazine *A*, fastened to the machine base *B*. The upper part of the magazine is shown broken away, the construction being similar to the section shown, with the exception that the sheet-metal tube guides *T* and *U* are flared slightly at the top to facilitate the insertion of the tubes. The sides of the guides are closed in by side plates to confine the tubes and also to support the zigzag guides.

The construction of the magazine is very much simplified by first riveting the strips *Y* to the side plates *V* and then soldering the guides in place. The under side of each section of the guides is left open, as indicated in the sectional view, Fig. 2. This arrangement permits the operator to see the tubes and adjust them horizontally if required; or, if a defective tube finds its way into the magazine, it can be swung around and removed.

The object in making the magazine of the zigzag type is to prevent the tubes from tilting as they pass down through it. Thus, if the operator inserts the tube in the top at an angle, when it strikes the first turn, it will straighten out. More-

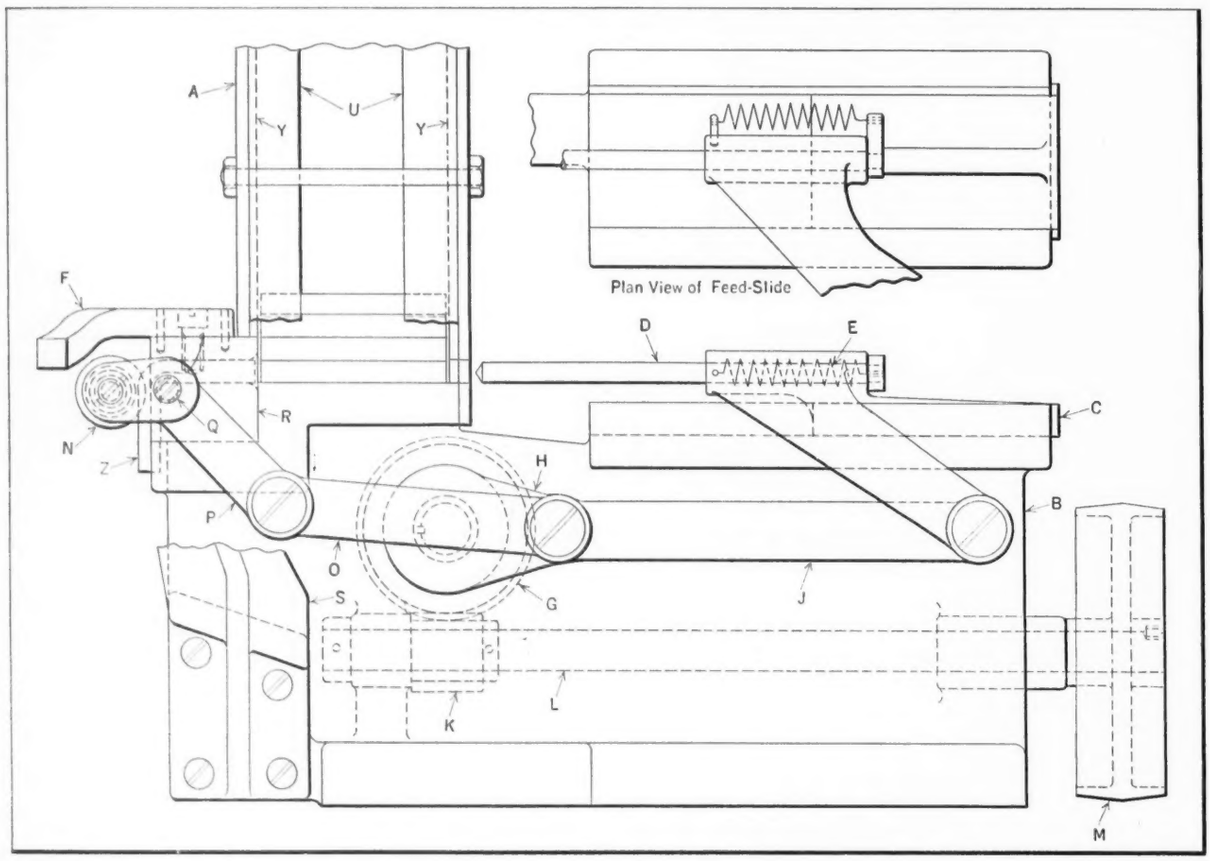


Fig. 1. Machine for Forming Elbows from Tubing

over, if the machine is allowed to operate until only a few tubes are left in the magazine, and then more tubes are inserted, these will be deposited horizontally one upon the other, since on the way down the guides, their position is corrected at each turn to a point close to the bottom. With a straight vertical guide, it is obvious that the tubes would be likely to "stack" at various angles. The several turns also permit the magazine to hold a greater number of tubes for a given height; consequently, the machine requires less attention.

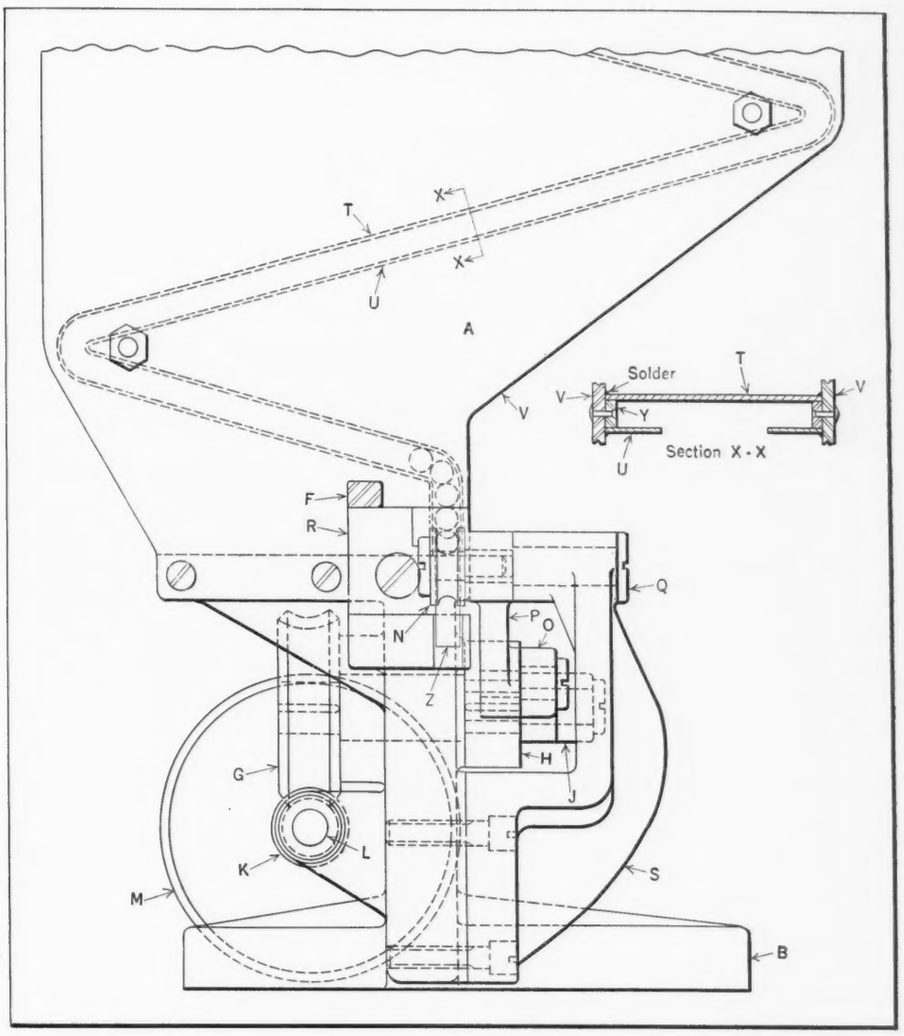


Fig. 2. View Showing Zigzag Construction of Magazine Used on Machine Shown in Fig. 1

On the base is mounted a reciprocating slide *C*, carrying the pusher-rod *D* for feeding the bottom tube to the forming rolls. It will be noted that this rod is backed up by a coil spring *E*, the purpose of which is to hold the tube tightly against the stationary stop *F* when the tube is in position to be formed. Slide *C* is reciprocated through link *J* by the crank *H*, keyed to worm-gear *G*. The worm-gear, in turn, is rotated by the pulley *M* at a constant velocity through the worm *K* pinned to the shaft *L*.

Crank *H* also serves to oscillate the grooved forming roll *N* through an angle of approximately 90 degrees by means of the link *O* connected to the arm *P*. This arm is an integral part of a bellcrank lever pivoted on the shoulder-screw *Q* in a bracket *S* fastened to the base. This bracket is broken away in Fig. 1 in order to show more clearly the action of the forming mechanism. Roll *N* is free to turn on a shoulder-screw in the upper arm of the bellcrank lever. Block *R* has a half-round groove in it corresponding to the finished elbow.

Let us now observe the action of the machine. The finished elbow is indicated at *Z*. Forming roll *N* has oscillated downward, forming the tube over block *R*. The right-hand end of this tube is prevented from swinging upward at the beginning of the forming operation, owing to the fact that the half-round groove at the top of the block terminates in a hole slightly larger in diameter than the tube. Now, as crank *H* rotates in a clockwise direction, the movement transmitted through link *O* causes lever *P* and roll *N* to oscillate in the same direction 90 degrees, so that the roll arm of the lever is vertical. At the same time, the movement of the crank transmitted through link *J* moves slide *C* toward the left, causing the point of rod *D* to centralize the bottom tube in the magazine.

The tension spring *E* keeps the rod at first from moving with the slide, the rod merely pressing against the end of the tube, because the formed elbow itself prevents the rod from forcing the bottom tube toward the left. However, as soon as the roll reaches its highest position, it clears the elbow. Then the thrust of the rod pushes both the bottom tube and the elbow toward the left. As a result, the elbow drops out of the machine by gravity and the left end of the tube is pushed against the stop *F*.

As the crank continues its rotation, the roll is swung downward, forming the tube into an elbow, and at the same time slide *C* and rod *D* are carried toward the right. When the rod emerges from the magazine at the end of this stroke, the next tube drops into position to be formed.

Engineering News Flashes

The World Over

Automobile Runs 134 Miles in 60 Minutes

A new world speed record was recently made in France where, at Montlhery, with a Panhard car, a course of 214 kilometers (134 miles) was covered in sixty minutes. This is a speed of over 2.2 miles a minute for sixty consecutive minutes.

Long Wear Due to Hard Facing

Remarkable savings have been effected at a cement plant by hard-surfacing the flights of screw conveyors. According to *Oxy-Acetylene Tips*, the average life of an ordinary screw is five weeks, whereas hard-faced screws will run about twenty-five weeks, or five times as long. The total cost for labor and materials for reclaiming three conveyor screws was less than $60. Since the cost of three new conveyor screws would have been approximately $570, the hard-facing process saved over $500 on this one job.

World's Largest Turbo-Generator Plant

What is stated to be the largest plant in the world for the exclusive building of turbo-generators has been completed at Kharkov in Russia. Operations were started early in the year. During the coming year it is planned to build, in this plant, two turbo-generators of 200,000 K.W. capacity, eight of 100,000 K.W., and six of 50,000 K.W. Of the machine tools used in this plant, about 25 per cent were designed and constructed in the Soviet Union. The plant will employ some 2700 workers.

A British Romance of Business

Spectacular developments of businesses are typically American, and it is more seldom that one hears of these business romances from abroad. A story comes from England, however, that is well worth repeating. It indicates how initiative and imagination still have a place in a business developed from small beginnings. Six years ago, a resident of Birmingham began to make toy cameras for children. One week he assembled cameras and the next week he closed his shop and walked around Birmingham selling them. The cameras caught the public fancy, and soon he found it necessary to rent additional space and employ a few assistants. Today, he heads the Coronet Camera Co., employing 250 people and producing toy cameras at the rate of four a minute.

Largest Motor Bus Seats 150

What is perhaps the largest motor bus in the world is now used at Boulder Dam for transporting workmen between their camp in Boulder City and the construction site. This bus has a wheel-base of 260 inches, is 10 feet wide, 15 1/2 feet high, and with its double-deck and longitudinal seating arrangement, has room for 150 seated passengers.

Autogyro Can Fly at Walking Speed

A new type of autogyro airplane having no wings, which can remain stationary in the air and land on an area not greater than a tennis court, has been built at Manchester, England, for the Cierva Autogyro Co., Ltd. After successful tests, the plane was flown to London. The movements of the plane, both horizontal and vertical, are controlled entirely by the rotor blades, which revolve like a giant windmill above the fuselage. The new plane reached a maximum speed of 115 miles an hour. Furthermore, against a wind of 10 miles an hour, the plane was clear of the ground when taking off in a distance of 30 feet. When landing vertically, the machine did not run forward as much as 3 feet after touching the ground. It proved itself capable of flying at a walking speed over the aerodrome and of climbing almost vertically at considerable speed.

Telephones on Moving Trains

The conductor in the caboose of a very long freight train can now carry on a conversation with the engine-man in the cab; conductors or enginemen of nearby trains can communicate with each other; and reports or instructions can be exchanged between trains and wayside stations. Work done by General Electric engineers has resulted in a new type of communication system—not radio—based on the principle of direct telephony. Ear-phones are not required; with five watts or less input into the inductor coils, loud speaker reception of ample volume to overcome train noises is received over a rail distance of five miles or more. The rails are

used as the medium for the transmission and pick-up of the signals, which are put into and taken out of the rails by inductor coils suspended from the caboose and locomotive at minimum clearance distance above the rails. These inductor coils are directly connected to the transmitting and receiving equipments.

20,000 Revolutions a Second

One million two hundred thousand revolutions per minute seems like an impossibility. Yet, at the recent exposition of the Chemical Industries in New York City, the Sharples Specialty Co., manufacturer of centrifuges, exhibited a centrifugal unit which was operated at a speed of 20,000 revolutions per second, or at a peripheral speed of 1390 miles per hour, which is believed to be the fastest rotational speed ever attained. The unit exhibited was designed by Dr. J. W. Beams, although the basic principle was developed in France as early as 1925.

The rotor is of conical shape having a maximum diameter of about 3/8 inch. It is mounted in a cup, also of conical shape, but of slightly different angle, so that the rotor is in contact with the cup only at its largest diameter. The cone is grooved with a series of flutes, and apertures are provided in the cup so that compressed air or gas may be directed against these grooves at such an angle as to cause rotation.

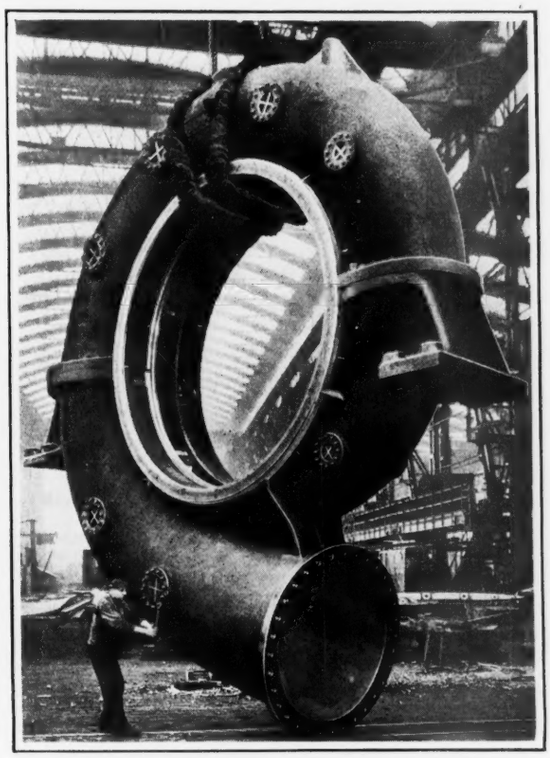
It is obvious that a speed as high as that mentioned cannot be attained if there is any bearing resistance. The unique feature of this device, therefore, is that the rotor rests entirely on a bearing of air. The air that is used to cause rotation escapes between the cone and the cup at high velocity and causes the rotor to float entirely free from any mechanical contact. Yet there is an apparent suction which prevents the rotor from coming entirely out of the cup, even if the entire device is inverted.

A Motor that Cannot be Overheated

A little metal disk inside of a thin steel case fastened to the outside of the frame of a newly developed Westinghouse refrigerator motor acts as a thermostat which automatically disconnects the motor from the line when it becomes too hot, and reconnects it after it has cooled down. During laboratory tests, such a motor, with its rotor locked, remained connected to the line day and night for two and one-half months, and at the end of that time, when the test was discontinued, was still in perfect condition.

Producing Gasoline from Coal

It is stated in *Industrial Britain* for February that work has begun on the erection of a plant in Great Britain to produce oil and gasoline from coal. The plant is being built adjacent to the Billingham-on-Tees Works of the Imperial Chemical Industries, Ltd. Obviously, an enormous plant is contemplated, since it is stated that steel to the value of $5,000,000 will be required and that the construction work will employ seven thousand men. The plant will take about a year to complete and is expected to produce over 200,000 tons of gasoline a year.



Mammoth Cast-steel Water Turbine Casing Built by the Krupp Works of Essen, Germany. This Casing Weighs 35 Tons and is One of Several Produced for a Large Hydro-electric Plant in Southern Germany

High-Efficiency Combustion Engine

Internal combustion engines now convert from 5 to 25 per cent of the actual energy in gasoline to useful work, according to F. R. Speed of the Ethyl Gasoline Corporation. He states, however, that one of the engines used in the Schneider Cup races represented an exceptional case in which an efficiency of 40 per cent was attained.

EDITORIAL COMMENT

Machine tool users who sell old machine tools in the second-hand market instead of junking them are likely to create for themselves undesirable competition. In many instances, these second-hand machines find their way into plants that, because of their low investment in equipment, are enabled to bid successfully for work in competition with firms having first-class equipment and acknowledged ability to execute the work properly. In the long run, the poorly equipped shop loses out; but, for a while it can demoralize an industry. Everyone concerned would be better off if obsolete equipment were junked.

Why Not Junk Obsolete Tools? Why Sell Them Second Hand?

There are some managers of industrial concerns who are scrupulously honest in all their monetary business dealings, who pay every bill when it is due, who treat their employes well and pay good wages, and who do not believe in overcharging their customers. But they do not hesitate to appropriate designs that have been developed by other plants.

As They Would Say in England, "This is Not Cricket"

It ought to be generally recognized throughout the industry that designs and ideas are property just as much as dollar bills, and that it is no more ethical to go into a man's plant and take away valuable ideas of new developments under the guise of being a customer, than it is to carry away some of the material property.

Fortunately, it is becoming more and more recognized that there are property rights in ideas and in designs, even when not patented, and that it is not ethical or honorable to make use secretly of designs that have been developed by another manufacturer at great expense. Nevertheless, once in a while it is done. Some of the codes recently adopted specifically condemn this practice, and others do so by inference. It should hardly be necessary to label this as unfair competition. Code or no code, it should be obvious that it is taking an unfair advantage of a competitor.

American industry has gradually risen to a higher conception of business ethics than that prevailing in earlier years. Eventually, it will be universally recognized that ideas in designs involve property rights, even when not patented.

The action of the National Automobile Chamber of Commerce in urging the Ways and Means Committee of Congress to recommend the discontinuance of discriminatory federal taxes on automotive products raises one of the most important questions of the entire recovery program. Declaring opposition to the principle of discriminatory taxation, the automobile manufacturers express the belief that whatever taxation is necessary should be general in character and should not discriminate against a specific industry.

Taxation Methods Can Make or Break Industry

Nothing could be fairer than this. Taxation can be made a means of encouraging and aiding industry or of hampering and curtailing industrial activity. Neither manufacturers nor economists have, in the past, given as much attention to methods of taxation as might have been advisable. Most of the taxes now levied are discriminatory, and for that reason, hamper the economic and industrial development of the nation.

Manufacturers in other branches should take cognizance of the action of the automobile manufacturers and should support them in their efforts to bring about more equitable taxation methods. The study of such methods is one of the most important steps toward permanent prosperity.

In the last analysis, production is the real purchasing power of the world. Money is but a chip in the game. There is no natural or sound reason for the breakdown of the public purchasing power other than the maldistribution of the fruits of the nation's industry.

Reducing production is *no solution.* Changing the money chips or their value is *no solution.* Dividing the work into smaller portions is *no solution.—Stephen Bell in Commerce and Finance*

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Multiple Lever Mechanisms Designed to Obtain Dwells in Lever Movements

By W. S. BROWN

The writer has met many engineers who did not realize that levers, in combination with links, could be used as a means for obtaining a dwell or idle period during the cycle of movements imparted to the lever of a driven shaft. The cam and follower-roll mechanism is perhaps the only simple one in which complete elimination of motion is obtained during the dwell period, but it cannot always be conveniently applied. Also, it is often difficult to obtain sufficient movement by means of cams.

When a close approximation to complete elimination of motion during the dwell period will meet requirements, levers and links provide a simple solution of the transmission problem, particularly when the driving and driven units are not located too close together. Fig. 1 illustrates a case of this kind, in which a hand-lever (not shown) mounted on the driving shaft operates two distinct mechanisms near the ends of its stroke, while the middle section of the stroke operates the driven shaft, which receives no noticeable movement when the other two mechanisms are being actuated.

The lever type mechanism has many advantages. For example, with the lever and link mechanism, it is a simple matter to increase or decrease the movement imparted to the driven member and change the direction of movement. Such mechanisms can also be easily arranged to avoid obstacles. Only simple parts which can be easily made in any machine shop are required for the lever mechanisms. These mechanisms operate smoothly and quietly without requiring any attention other than an occasional oiling. All the levers shown in Fig. 1, together with some that are not shown in the illustration, were required for the transmission of motion from the front of a machine to a higher position at the rear. This is accomplished, with the additional feature of a dwell period of the driven shaft near each end of the stroke of the driving shaft.

In operation, the lever A on the driving shaft moves from position A_1 through A_2 and A_3 to A_4, serving to operate two mechanisms (not shown) from levers also mounted on the driving shaft. The movement from A_2 to A_3 is transmitted to the lever on the driven shaft, causing it to move from E_1 to E_3. Lever E on the driven shaft dwells while the lever on the driving shaft is moving from A_1 to A_2 and from A_3 to A_4. The first dwell of the lever on the driven shaft, as lever A moves toward A_4, occurs while the lever on the driving shaft moves from position A_1 to A_2, and while the longer or driving arm of the bellcrank H swings from H_1 through the neutral point to H_2, causing lever E to move only a very short distance, as indicated by the full line and the dot-and-dash line. The actual overtravel transmitted to lever E at this

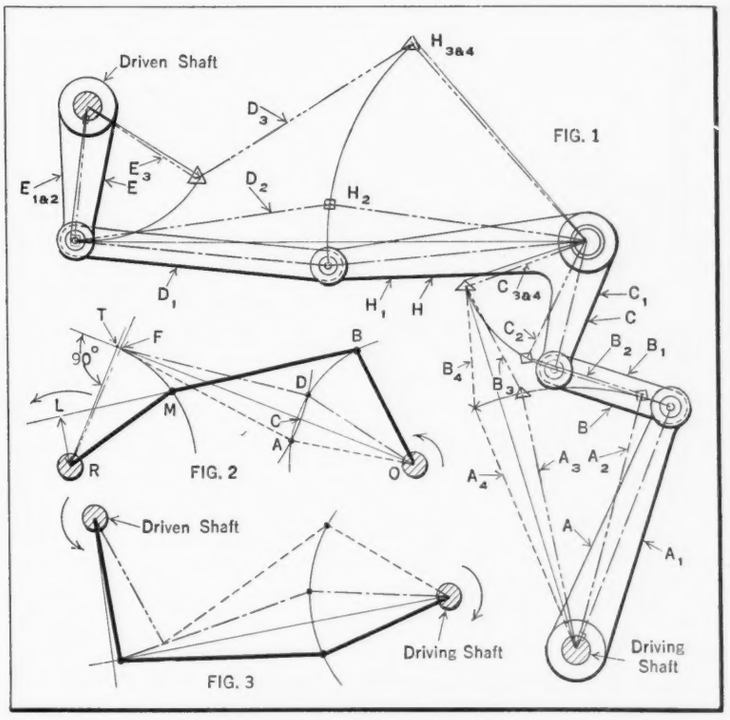


Fig. 1. Lever and Link Mechanism Having Dwell Period for Driven Shaft at Each End of Oscillating Movement of Driving Shaft. Fig. 2. Diagram Used to Illustrate Method of Laying out Lever and Link Mechanisms. Fig. 3. Arrangement for Obtaining Dwell at Beginning of Driving Lever Stroke with Shafts Turning in Opposite Directions

time amounts to an angular movement of only one minute. Even this small movement can be reduced by incorporating a similar arrangement at another point in the transmission system. As a matter of fact, the motion of lever E during the dwell period does not exceed 8 per cent of the total movement.

The movement of lever A from A_3 to A_4 results in transmitting practically no movement to link B and lever C. This movement simply causes positions C_3 and C_4 to become merged at one point, giving corresponding positions H_3 and H_4 to lever H. It is generally necessary to increase the length of the driving levers or decrease the length of the driven levers to compensate for the decreasing effects, on the driven levers, of the angular motions of the drivers as they approach the position of dwell. This can be conveniently done, but the designer must be careful not to reduce too greatly the moment arms of the driving forces in the links.

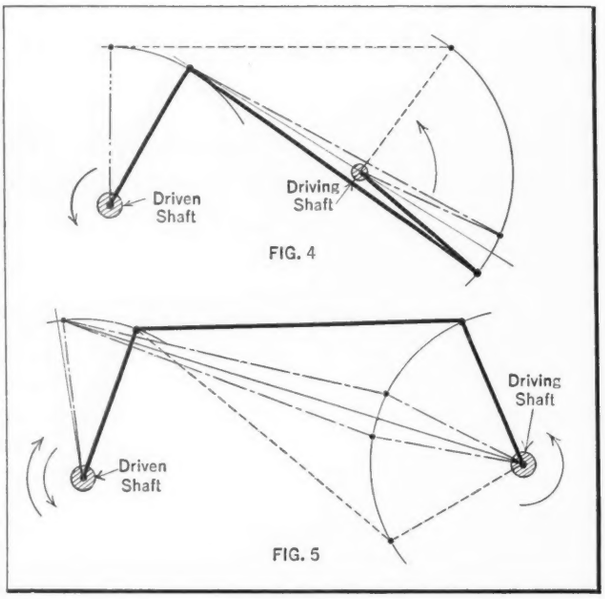


Fig. 4. Levers Arranged to have Driven Shaft Dwell at Beginning of Driving Shaft Stroke with Both Shafts Turning Counter-clockwise. Fig. 5. Arrangement for Dwell at Mid-point of Driver Oscillation

Incidentally, it may be mentioned that link and lever arrangements of this kind are self-locking against the reversal of the lever movements when the driving lever is at each end of its stroke. In the case illustrated, there was no necessity to utilize the toggle action of the levers for the production of heavy pressure or for locking purposes, but this feature might be useful in some cases.

The general method of laying out a mechanism of this kind is illustrated in Fig. 2. This lay-out can be varied considerably without seriously affecting the results. First, the approximate or definite locations for the driving and driven shafts are laid out and the directions of the motions are determined, so that intermediate levers and links can be sketched in for a preliminary trial. Isolating one unit, as in Fig. 2, arcs representing the swing of the link-pins are drawn, and from the center of the driving shaft is drawn line OCT tangent to the arc of the driven link-pin.

It is not absolutely necessary to have line OCT in the tangential position, but this position ordinarily gives the best results. From the center of the driven shaft, line RT is drawn at right angles to line OCT. Now, CT represents the length of the connecting link. From C mark off at D and A arcs representing one-half the angle through which it is desired to eliminate the transmission of movement to M, and with length CT and centers A and D draw arcs which cut OCT at F. This point F is the final position of the driven link-pin. From OA lay off the point B, so that arc AB subtends the whole angle of rotation of the driving lever. Then point B is the starting position of the driving link-pin.

From point B, with a radius equal to CT, draw an arc cutting the arc of the driven link-pin at M. Now, RM indicates the initial position of the driven lever, while BM indicates that of the link. Thus, it will be seen that while the driving lever is given a continuous forward motion, the driven lever moves forward up to its final position and then has a slight additional forward motion, after which it returns to its final position. This last reciprocating movement between F and T is usually so slight as to be negligible. This slight movement also acts on the driven lever in such a direction as to produce the minimum amount of angular movement.

In order to "kill" or eliminate motion at the beginning of the stroke instead of at the end as just described, and at the same time retain the same direction of rotation for both levers, it will be necessary to carry the lever-pin to the right-hand side of the driving shaft. This necessitates using an overhanging transmitting lever and link, in order to allow the link to pass across the center of the shaft—see Fig. 4. If it is possible to reverse the direction of the driving lever, elimination of the motion at the beginning of the stroke can be achieved by the arrangement shown in Fig. 3.

Fig. 5 shows another arrangement in which the dwell occurs at the mid-point of the swing of the driving lever, so that the driven lever is given an oscillating motion with a dwell at the extreme left-hand position.

Mechanism for Instantly Disengaging Clutch at Point of Overload

By J. E. FENNO

Many mechanisms designed to disconnect the power drive to the machine when it becomes overloaded function only at one point in the operating

cycle. With the mechanism shown in the illustration, however, the machine clutch through which power is transmitted to the slide, is disengaged instantly, at the exact point in the slide movement at which the overload occurs.

This arrangement is incorporated in a machine for assembling metal caps on electric fuse plugs, a number of the plugs being capped simultaneously. The capping tool slide actually consists of two slides *A* and *B*, slide *B* being superimposed upon slide *A*. Slide *B* carries the capping tools and is normally held in one position relative to the main slide *A* by means of a stiff coil spring *E*.

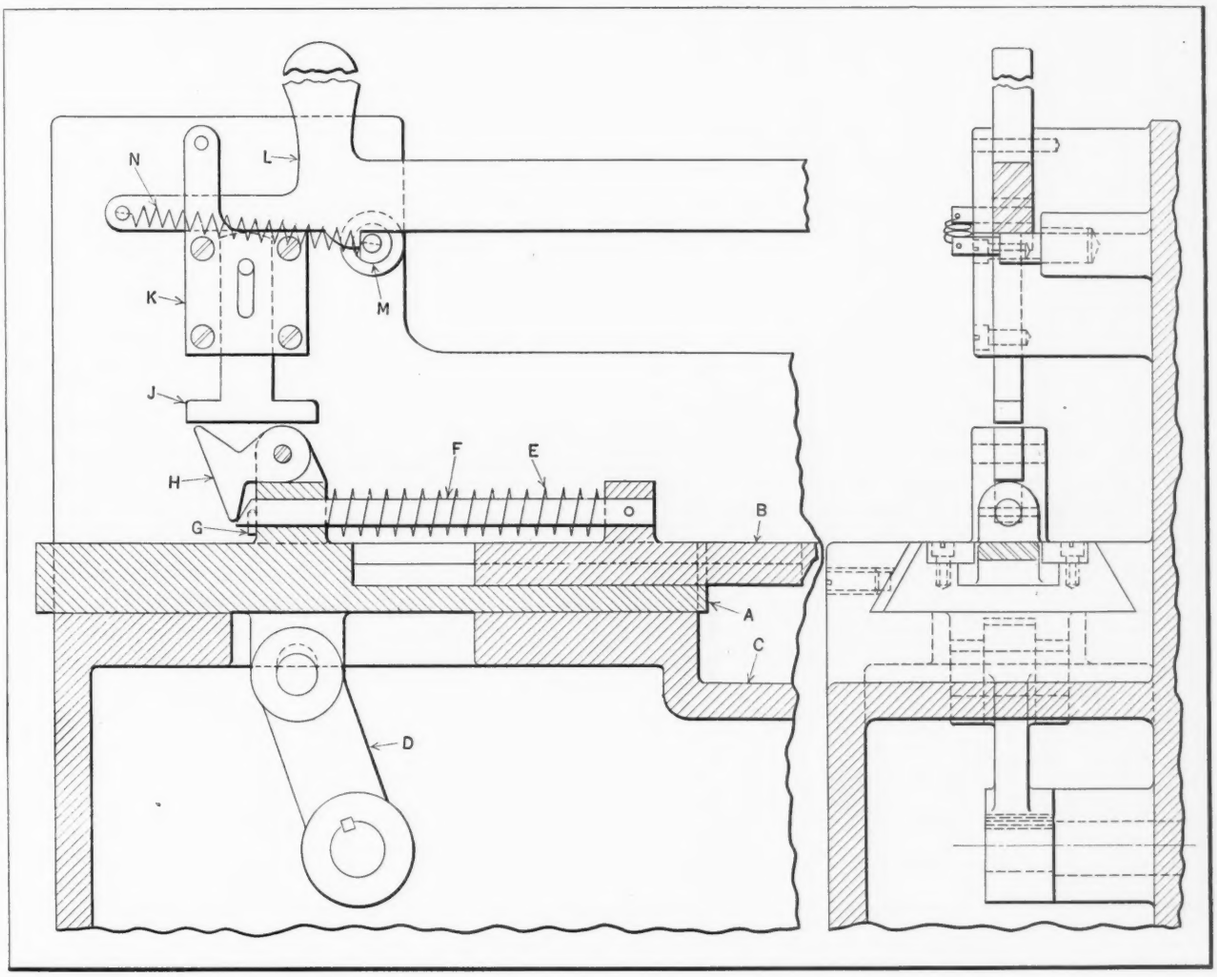
If the tool-carrying slide *B* meets with an obstruction, it telescopes into the main slide, actuating a latch *H*, through rod *F*, which causes a spring-operated hand-lever *L* to shift and disengage the machine clutch. Although not shown here, a band brake operated by the same hand-lever prevents over-run of the machine members after the clutch is disengaged. Slide *A* is reciprocated in a dovetail guide in the machine frame *C* by the oscillating lever *D*. This lever is actuated by another member of the machine (not shown).

Rod *F*, together with stop-pin *G*, limits the telescoping movement of the slides, in addition to tripping the pawl *H* when the slide meets an obstruction. Pawl *H* is pivoted at the top of the main slide lug, and when swung upward, engages latch *J* sliding in the guide *K* on the machine frame. The upper end of this latch, when the latter is raised by pawl *H*, serves to disengage the clutch lever *L* from the stationary pin *M* in the machine frame.

The coil spring *N*, secured to pin *M*, then forces the lever *L* toward the right, disengaging the machine clutch and applying the band brake. All these movements take place at practically the same instant that the overload occurs, so that no further movement of slide *B* results after meeting the obstruction. Slide *A* is then moved to the left by hand and the obstruction removed, after which the machine is started by shifting lever *L* back to its original position.

* * *

During 1933, there were 36,744 patents applied for in Great Britain. Approximately the same number of patents was applied for in 1932. It appears that the inventor is as busy as ever. Many of these inventions will prove to be the basis for important industries in the future.



Mechanism for Stopping Slide Automatically when it Becomes Overloaded

A New Gear-Charting Machine

Combined Errors of Tooth Profile, Tooth Spacing, Tooth Interference, and Eccentricity are Indicated on a Chart for Permanent Record

IN inspecting or checking gears, it is of great value to obtain a chart or record of the checking operation. When this chart can be produced mechanically and automatically during the operation of checking, it saves the time of plotting the chart by hand on cross-section or ruled paper. Not only does the mechanically produced chart give a more accurate picture of the condition of the mating gears, but it also permits deductions as to what is wrong with the mating gears to be made more rapidly and easily.

The Illinois Tool Works, 2501 N. Keeler Ave., Chicago, Ill., have developed a new machine known as the Illinois gear-charting machine for the purpose of producing charts of running gears to show the combined errors of tooth profile, tooth spacing, tooth interference, and eccentricity. In regular practice, the gear to be tested is run with a ground master gear. This ground master gear is of known accuracy, and, therefore, any variations shown on the chart are caused by the gear being tested. Production gears may also be run with each other to show the combined error between two mating gears.

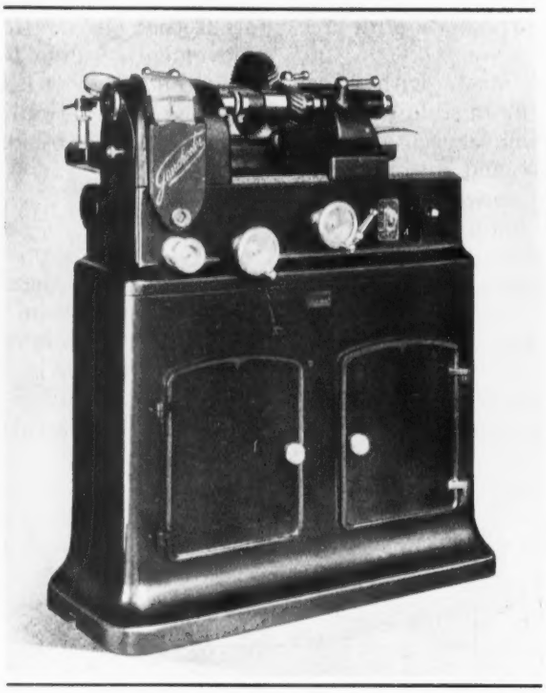


Fig. 1. General View of the Illinois Gear-charting Machine

In addition to the fact that a permanent chart is produced, this equipment has the advantage of enabling individual errors to be separated from the others and analyzed. This is possible because the gears can be rolled by hand and any tooth profile error, interference, or irregular spacing can be observed on an indicator. The gears may also be set at the correct center distance and the backlash measured with an indicator. After these various hand tests have been made and each individual error has been observed, the gears may be rotated by power and a chart produced which gives a record of the combined discrepancies.

The interpretation of a chart so made is quite simple. Certain types of irregular lines are compared with the hand-rolled characteristics. If, for instance, the gear rolling with a master gear produces fairly regular curves and each curve synchronizes with a gear-tooth contact, then it is quite certain that the pressure angle of the tooth profile is incorrect. The curves shown in Fig. 2, for example, indicate incorrect pressure angles. The conclusions based on these curves can be corroborated by the hand-roll test by noting that the indicator needle is in constant motion during the entire tooth contact.

When the line on the chart is fairly straight, except for humps at regular intervals, the indications are that the tooth spacing is incorrect where the humps occur. An occasional hump may also be produced by a mutilated gear tooth, as indicated in

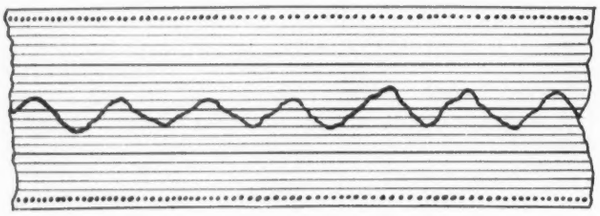


Fig. 2. Regular Deviations, One for Each Tooth in the Gear, as Shown in This Chart, Indicate Incorrect Pressure Angles

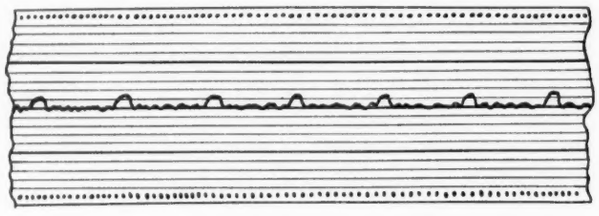


Fig. 3. Humps at Regular Intervals Show Uneven Tooth Spacing. An Occasional Hump Indicates a Mutilated Tooth or Chips

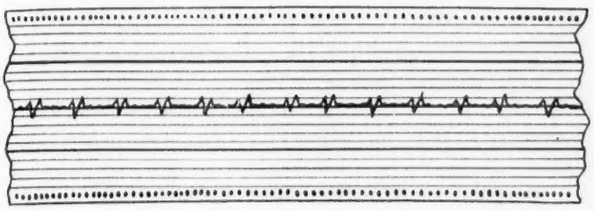


Fig. 4. Partly Smooth and Suddenly Wavy Line for Each Tooth Contact Indicates Interference or Too Much Tip Relief

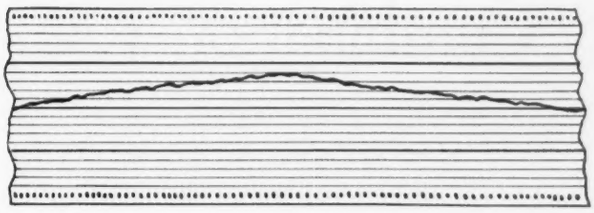


Fig. 5. A Long Curved Line that Does Not Run Parallel with the Ruled Lines on the Chart Shows Eccentricity of the Gear

Fig. 3. This condition can be verified by the hand-rolling process by noting that the indicator needle fluctuates greatly at the place where the tooth-spacing errors occur. A mutilated tooth will also show severe fluctuations of the indicator needle during the tooth contact with the master gear.

A line on the chart that is partly smooth and then suddenly wavy for each tooth contact indicates interference at the top and bottom of the gear teeth, or else too much tip relief on the gear teeth. The reason for this action is that the true involute profile causes uniform rotation; but in the case of too much tip relief, the involute is not long enough to cover the arc of contact, and the gear tooth falls into the mating gear and bears on the tip relief, causing a sudden fluctuation in the charted line.

The same condition occurs in reverse order when there is tip interference. The involute profile then causes uniform rotation, but as the tip of the gear tooth passes out of contact with its mating tooth, it may ride on a fillet on the bottom of the mating tooth, or the tip itself may be "fat" and thus cause a sudden fluctuation of the charted line. Such sudden fluctuations are indicated in Fig. 4. The relationship of the smooth and wavy line can also be checked by the hand-roll method, and the allocation of the smooth and wavy action to the gear-tooth contact may be noted on the indicator.

If the charted line, either wavy or smooth, does not run parallel with the ruled lines on the paper chart, this is a sure indication of eccentricity in the tested gear, as shown in Fig. 5. In all tests, it is common practice to have the gear to be tested make one complete revolution, which can readily be done by placing a chalk mark on the gear. The amount of eccentricity can be determined by noting how many ruled lines are covered, as each space on the chart is equal to 0.001 inch on the gear. In the hand-rolling process the amount of eccentricity can also be shown by the dial indicator.

By the aid of these combined-error charts, records can be kept for subsequent set-ups on gear production. Comparisons can also be made between a "green gear" and its condition after hardening.

There are two common methods of checking center distance. One makes use of permanent non-adjustable studs set into a plate, a separate plate being required for each different pair of gears. The other makes use of gear studs in slides which are adjustable, the distance being measured with a micrometer or vernier. In the gear-charting machine here illustrated, the centers are adjustable, but the center distances are quickly obtained by inserting a gage between the hubs on the front and back headstocks. In automobile, truck, and tractor production only a few center distances are encountered, and these templet gages permit immediate and accurate change from one center distance to another. This method is faster than the use of micrometer measurements and cheaper than the use of solid non-adjustable studs.

The new gear-charting machine has a height of 45 inches, a length of 40 inches, and a width of 19 inches. It weighs 1050 pounds.

The Illinois Tool Works have also developed three other gear-testing machines which will be described in subsequent numbers of MACHINERY. While the present machine charts the combined errors in a gear, the machines to be described measure individual errors. One machine checks the normal pitch space; another, the involute profile; and the third measures the lead of helical gears or worms.

* * *

Ancient Ball Thrust Bearing

By PENN HALL, Philadelphia, Pa.

In February MACHINERY, page 336, it was mentioned that anti-friction bearings were used one hundred years ago. As a matter of fact, anti-friction bearings are a great deal more ancient than that. At the Chicago Fair in the Italian section of the Hall of Science, there was shown a large ball thrust bearing made of wood, approximately 3 feet in diameter, with brass balls, about twelve in number, which rolled in the wooden grooves. This bearing is supposed to have been used by the ancient Romans.

* * *

If depreciation is involved in the operation of the processes of manufacture, it must not be omitted from the calculation of cost. Since the object of the depreciation charge is to provide funds for perpetuating the business, the only sound basis for the charges is *replacement* value, most certainly not *depreciated* value.—*Robert Scudder Denham*

Combination Die of Unusual Design

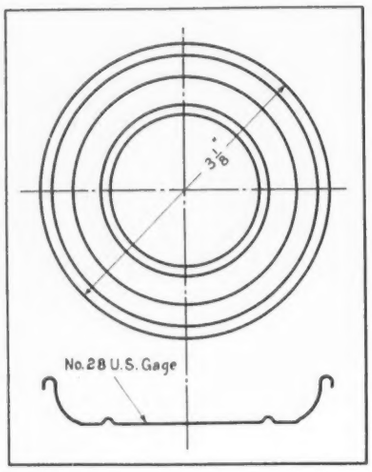


Fig. 1. Ash Tray Blanked and Formed from Sheet Steel in One Stroke of Die Shown in Fig. 2

A COMPLETE ash tray, of the size and shape indicated in Fig. 1, is produced at each stroke of the press, operating at sixty strokes a minute. The V & O Press Co., Hudson, N. Y., has designed a combination die that performs five operations at every revolution of the press. This combination die differs from the ordinary die of this type in that after it produces the inverted shell shown in the second step of Fig. 3, it reverses the draw in the next two operations, and in the final operation it embosses the bottom of the ash tray with whatever design may be required. Details of the die construction and its action are shown in Fig. 2.

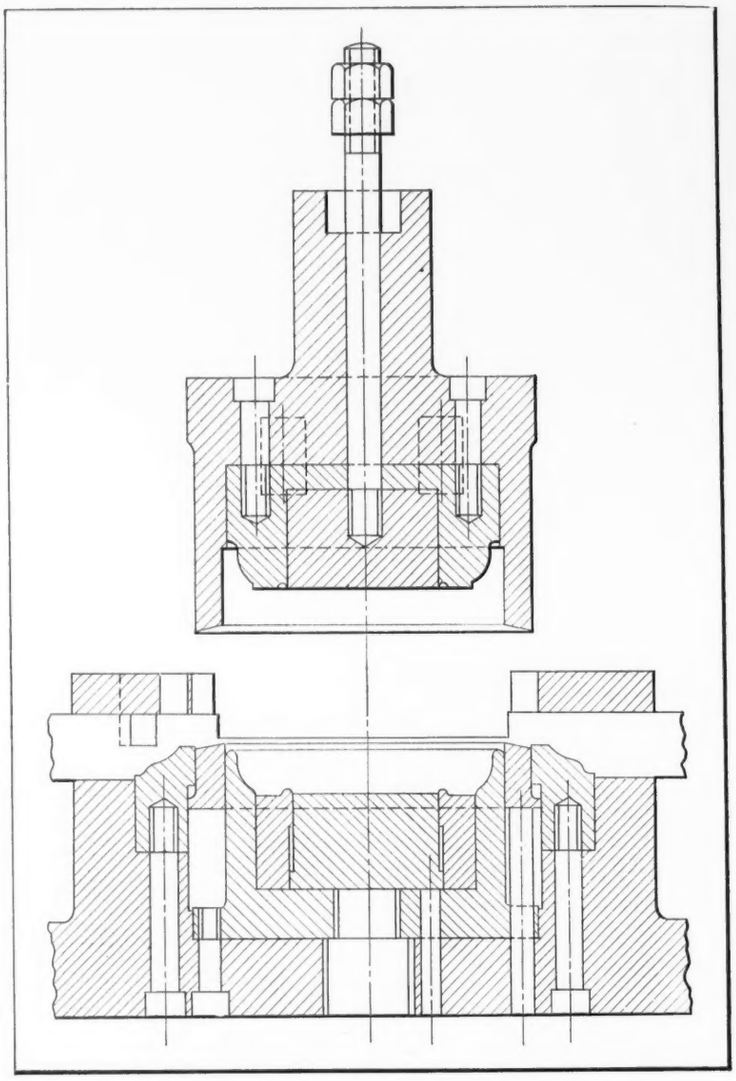
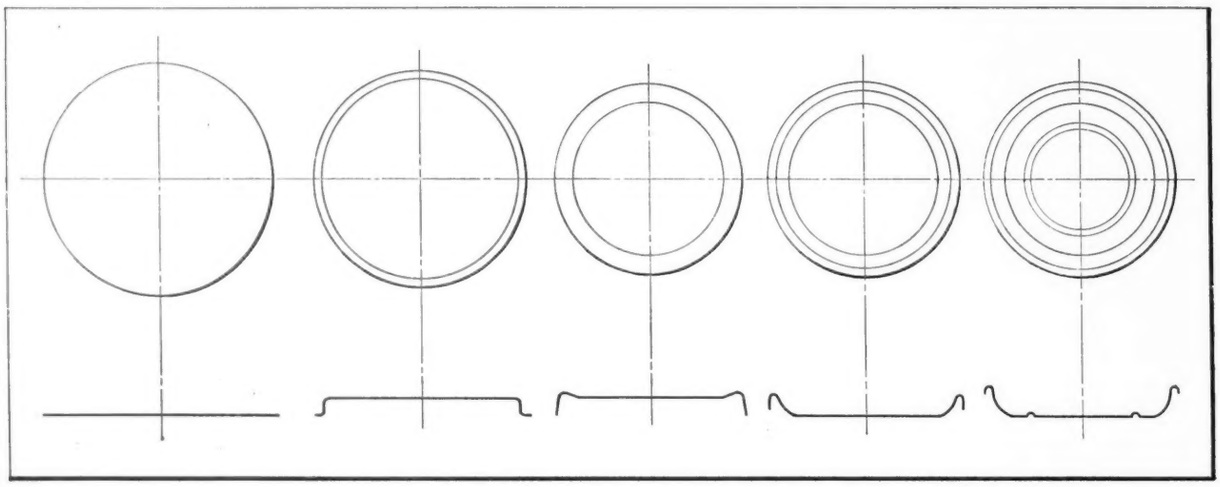
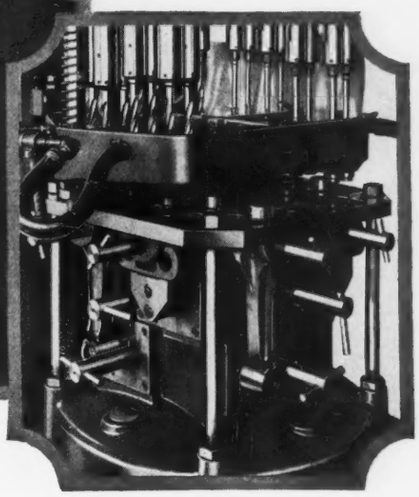


Fig. 2. (Above) Die for Producing Ash Tray Shown in Fig. 1 at the Rate of Sixty a Minute. Fig. 3. (Below) Diagrams Showing Five Successive Steps in Forming Ash Tray at One Stroke of the Die



Design of Tools and Fixtures

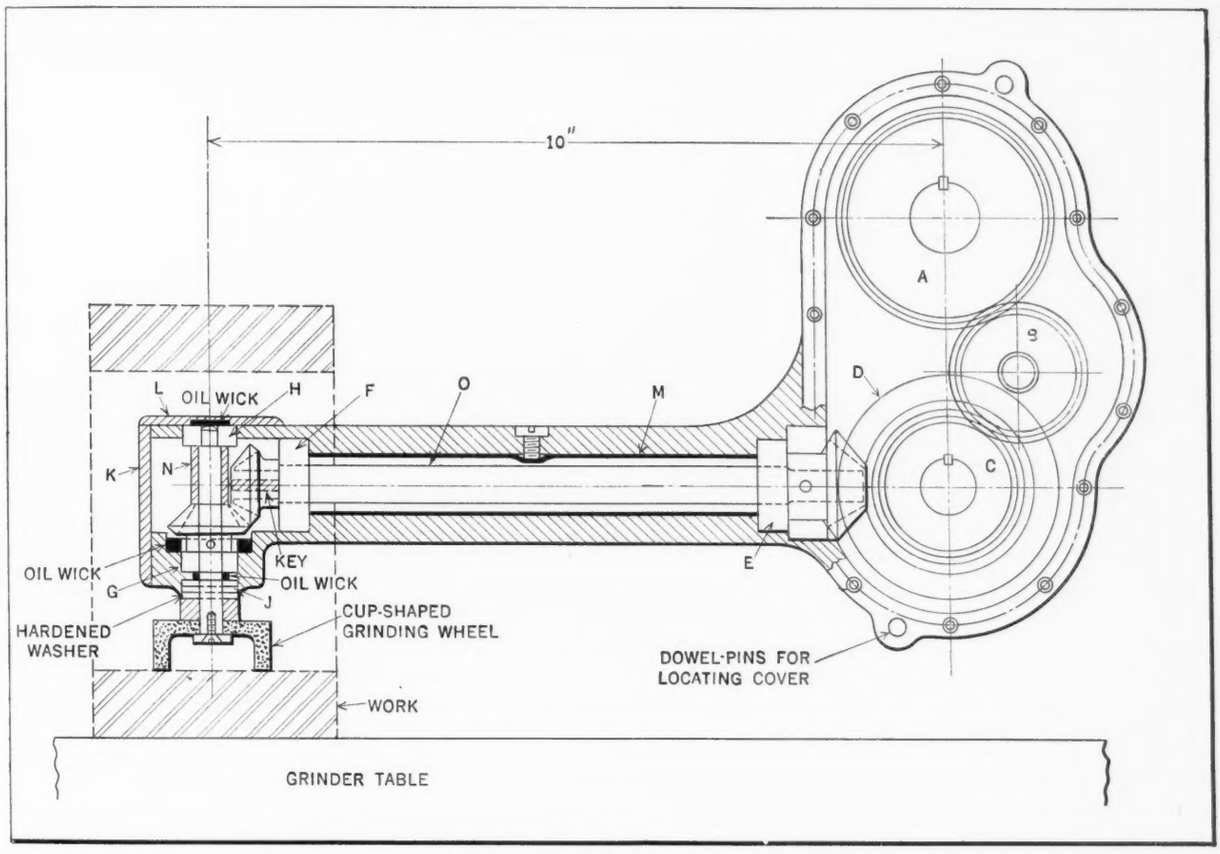


Internal Surface Grinding Attachment for Use on Plastic Molds

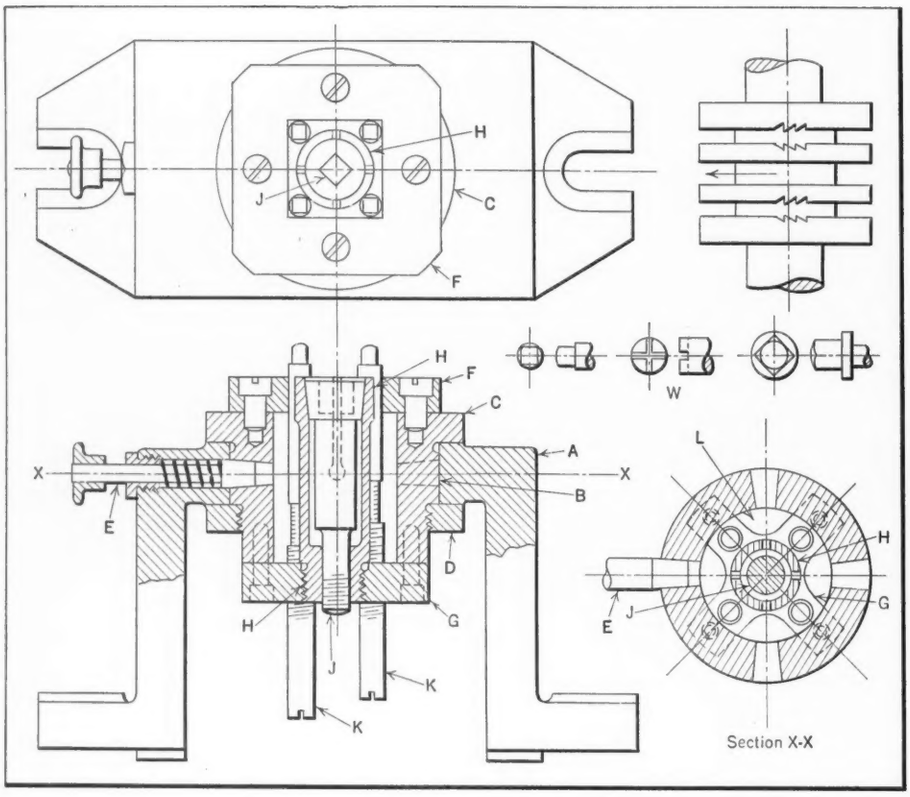
By C. W. HINMAN, Orlando, Fla.

The attachment shown in the accompanying illustration was designed for a No. 2 Brown & Sharpe surface grinding machine. It is used for internal grinding operations on the side walls of plastic molds or similar inaccessible surfaces. Some form of cup-shaped grinding wheel is used. The work may be clamped on the machine table or held on a magnetic chuck.

The body housing and arm are of cast iron, cast and cored in one piece. The illustration shows the attachment with the cast-iron cover removed from the body housing to show the gear driving arrangement. The body of the fixture is rigidly attached



Internal Surface Grinding Attachment Used in Making Plastic Molds



Indexing Fixture Used for Slotting or Squaring Heads of Four Pins or Screws Simultaneously

to the head of the machine by a bolt (not shown) in the rear of the housing.

The gear train is designed to drive the grinding wheel at 8000 to 9000 revolutions per minute. All bearings are enclosed, and lubricated with sperm oil by the wick lubricating method.

Gears *A*, *B*, and *C* are of the spur type, but the spiral or helical type might have been used. Driving gear *A* is driven by the main driving shaft on the grinding machine. Gear *B* is an idler between gears *A* and *C*. Gear *C* is keyed to the same shaft as bevel gear *D*, which, in turn, drives shaft *O*. The three housing gear-shafts are supported by phosphor-bronze, oil-grooved bearings.

The cup-shaped grinding wheel is driven by a pair of miter gears from shaft *O*, as shown. Self-aligning annular ball bearings are used at *E*, *F*, *G*, and *H*. A special thrust ball bearing is used at *J*, which provides for the grinding wheel thrust. A separating sleeve is provided at *N*, which supports the upper bearing *H* and also helps to take the thrust. The covers are mounted as shown at *K* and *L*. A tubular wick *M* surrounds shaft *O*, and is saturated with oil introduced through the central screw shown in the arm. The main housing is packed with 600W, medium heavy grease, such as is used in automobile transmission cases. The cover is mounted on the housing with a gasket between.

There was one machining difficulty in making this fixture—the counterboring for bearing *E* had to be done with a reversed counterboring tool through the hole in the arm. Two of these grinding attachments were built. The first one proved a complete failure, as is likely to be the case with very high-speed tools unless the designer has had considerable experience in designing ball-bearing machines that run at high speeds. The correct procedure in designing high-speed ball-bearing machines is first to present the problem to the engineers of the company from which the bearings are to be purchased and follow their advice.

High-speed ball bearings require very little lubrication, but that little is essential. The lubricant must be free from acids or alkalies, as both of these will pit the surfaces of the balls and races. Usually a good mineral oil is better than a vegetable oil. Vegetable oils soon become rancid. Sperm oil or other good fish oils are excellent. If the lubricant is fed directly to a high-speed bearing in motion, it is immediately thrown off; a wick feed prevents this difficulty. The wick also serves to filter the oil, thus preventing foreign matter from entering the bearings and causing damage.

The attachment described was in such great demand after neighboring shop men heard of it, that it was found profitable to rent it out for use in other plants.

Milling Fixture with Indexing and Multiple Clamping Features

By H. THORNTON, Newark, N. J.

The milling fixture shown in the accompanying illustration grips four parts in one setting and permits the group of clamped pieces to be indexed to a position at right angles to the first position for a second operation. Thus, screws and studs requiring slotted or squared heads, such as the three different types shown at *W*, for example, can be machined in two operations with straddle-milling cutters without unclamping or resetting the work for the second operation. This insures greater speed and accuracy. The fixture comprises the conventional base *A* with a barrel member *B* held in frictional contact with the base by means of the flange

C and the retaining collar D. Barrel B can be indexed and locked in the required position by means of the pin E.

To the top of member B is fastened a square plate F having a square opening in it. To the bottom of barrel B is fastened the spider G. Screwed into the spider is the collet H. The expanding bolt J, in turn, is screwed into the collet. The cross-section X–X shows the relative position of the spider with respect to the index-pin, the latter being parallel with the sides of the square opening. The legs of the spider extend diagonally to the corners of the square.

The pieces to be milled are inserted in the corners of the square, where they are securely clamped by the expansion collet. Four adjusting screws K at the ends of the spider resist the downward thrust on the work. These screws are adjustable for work of different lengths. The collet H is made interchangeable to accommodate work of different diameters. Two pairs of cutters may be spaced to straddle-mill the squares, as shown in the illustration, or two circular saw blades may be properly spaced for slotting operations. Ample chip clearance is provided by a hollow base and gaps L in the spider.

Forming Threaded Caps of Soft Metal on a Punch Press

By E. BELL HARE, Stratford, Conn.

An interesting punch press job is performed in the production of a threaded cap used in connection with an ingenious method of holding a certain fluid in a thin copper cartridge.

The threaded cap, shown in the enlarged view at A, Fig. 1, is the last member assembled in the cartridge, and serves to seal the fluid in by a friction fit. The ultimate design of the die used to form this threaded cap is shown in Fig. 1. The blank B is regular buck-shot, 1/8 inch in diameter. The size is held within close limits, as an excess of metal would necessitate an additional operation, in order to bring the caps to size, and a deficit of metal would, of course, result in the formation of an incomplete cap.

The buck-shot used for blanks is formed at an ammunition shop in the conventional gun-shot tower, and later sorted to size. This shot was so accurate in size that all losses of weight disappeared and increased economy was effected. As the punch C descends on the buck-shot blank B, the metal is

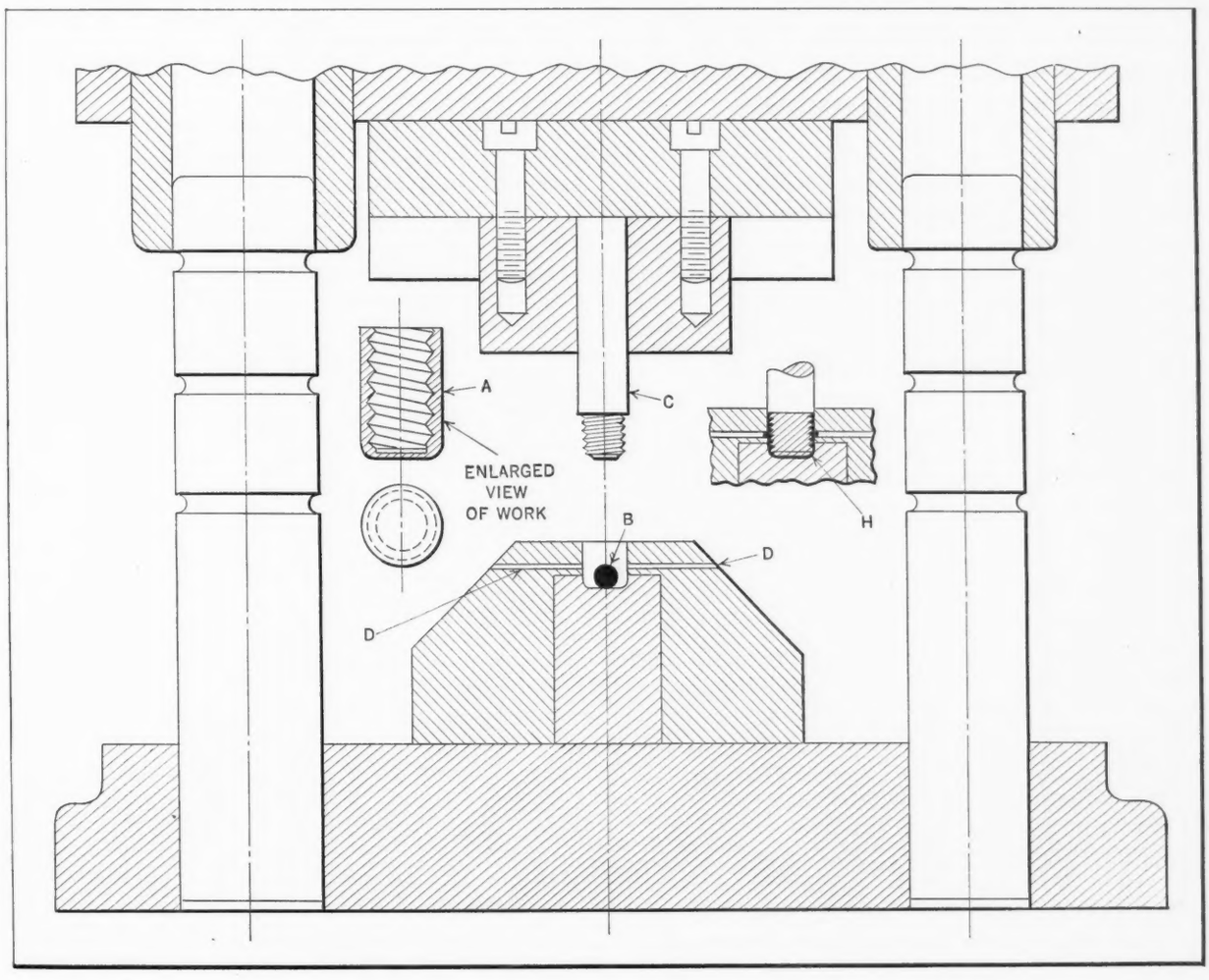


Fig. 1. Punch for Forming Threaded Caps from Spherical Lead Blank B

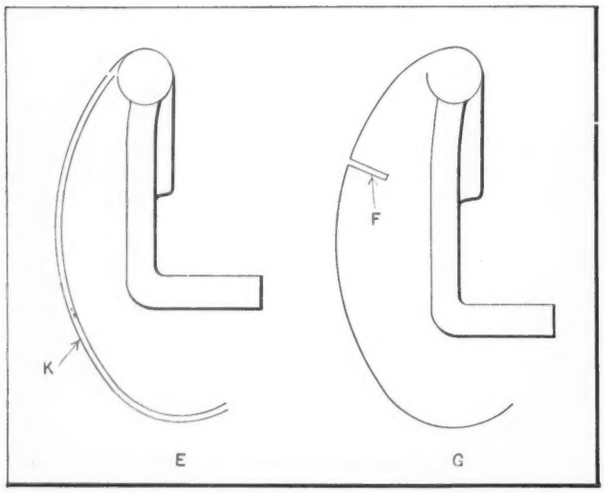


Fig. 2. The Ribs K of the Press Uprights E were Removed and a Saw Cut F Made in the Web, as Shown in View G, to Provide the "Springiness" Required in Using the Die for Forming Four Parts A, Fig. 1, Simultaneously

forced to flow upward so that it envelops the punch, as indicated at *H*. On completing the cycle, the formed cap is withdrawn from the die by the punch and unscrewed from the threaded end. This was done by hand with the aid of a special "pinch wrench."

The cap has a triple thread, and can be removed quickly when started, although considerable initial pressure is required to start it. Automatic methods have been devised to remove the cap, but so far they have failed to compete successfully with the hand process of a skilled operator. The rapidity of flow of the metal can be understood when one considers that the punch descends at the rate of 150 strokes per minute. The pressure used for this forming is approximately the same as that required to blank a piece of brass 2 inches long, 1 inch wide, and 0.025 inch thick.

The die has two holes *D* leading from the die cavity to the outside. These holes serve as an outlet for the entrapped air when the punch descends to form the cap. Although it might appear that burrs would form in these holes, it is only once in a great while that a slug of metal is entrapped in these channels.

As the demand for these caps increased, it was deemed advisable to make a die that would form four caps per stroke. This necessitated the purchase of a new press. When first run, the new press gave very unsatisfactory results. On investigation, it was noted that the press had reinforced uprights, as shown at *E*, Fig. 2. These ribs *K* constrained a certain "springiness" in the press. By cutting away these ribs and making a slot *F* in the upright, as shown in the view at *G*, successful results were obtained.

Slotting Fixture with Wedge Clamping Arrangement

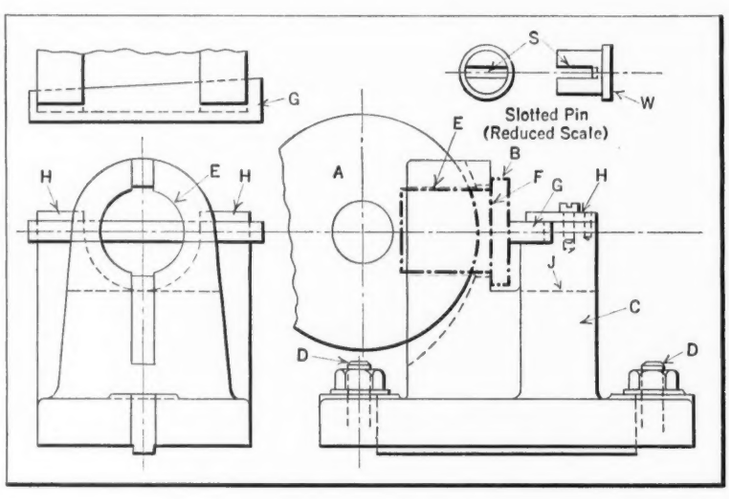
The fixture shown in the accompanying illustration was designed for use in cutting the deep slot *S* in the pin *W*, which has a very short head. The cutter for milling the slot is indicated at *A*, the work is shown in place in the fixture at *B*, while in the upper right-hand corner are two views of the pin as slotted. The base *C* of the fixture is attached to the milling machine table by bolts *D*.

The work is inserted in the hole at *E* for centering purposes, its shoulder being forced against the finished surface *F* by a tapered wedge *G* (also shown in the view at the upper left-hand corner of the illustration). Two plates *H*, retained in place by screws and dowels, keep the wedge in position, the practice being to rap the large end of the wedge lightly with a hammer in order to clamp the work tightly in place. A tap on the small end of the wedge releases the work.

At *J* is indicated a clearance hole that permits the work to be pulled out of the fixture when wedge *G* is removed. After the wedge has been removed, a pin to be milled can be easily put in the fixture; the wedge is then slipped into the groove again and set tight against the work. Clearance cuts are provided in the fixture for the cutter. F. M.

* * *

Artificial lighting is claimed to be actually better than daylight for the best lighting conditions. Engineers of the Westinghouse Lamp Co. state that, while during the course of the day sunlight changes in color, direction, and intensity, resulting in conditions that produce a strain on the eyes, artificial light remains constant. For this reason, lighting engineers have been advocating artificial light in preference to natural light for a number of years. Already a factory has been constructed without windows, and several offices have been arranged for artificial lighting exclusively.



Fixture Used in Cutting Slot S in Pin W

The Shop Executive and His Problems

Superintendents and Managers are Invited to Exchange Ideas on Problems of Shop Management and Employe Relations

THE present methods of governmental control of business make Government virtually a partner in industrial enterprises, for Government prescribes methods of operation with an authority that can be assumed only by a partner.

To the extent that this regulatory effort of the Government is exercised with the idea of promoting the interests of all business, and through business, the interests of the entire nation, this partnership idea is good; but if the power of Government is exercised, as in some instances it might be, to the detriment of industrial enterprises and for the benefit of some other group of the population, the benefits of the partnership are doubtful. It is quite possible to imagine the Government as exercising its powers like a partner who is engaged in several different enterprises, and who uses his influence to the detriment of one or more of the enterprises in which he is engaged, to benefit some other enterprise in which he is also a partner.

Partnership implies not only authority, but responsibility. It is to be hoped that our Government, in assuming this partnership with industry, will also fully recognize its responsibility. It is always difficult for a government to recognize responsibility, because governmental affairs, by necessity, have to be delegated to individuals, many of whom, each in his place, are prone to accentuate their authority more than their obligations. Let industry, however, do all that it can to impress upon governmental officials that their responsibilities are fully as great as their authority. N. M.

Depreciation and Replacement of Equipment

The editorial "The Application of a Common-Sense Rule Becomes News," in March MACHINERY, page 402, presents an idea of the greatest importance to industry. An accountant may raise the objection that the original capital cannot be dissipated by paying it out in dividends, since this is illegal, but that is merely arguing about terms. The fact remains that many a concern has shown profits on its books, making it perfectly legal to pay dividends, while the machinery in the plant has gradually deteriorated and no cash has been available for buying new equipment. The effect of this is the same as if the capital itself had been dissipated by paying it out in dividends, even though this has not actually been done.

There is no royal road to business recovery, nor to the prevention of future depressions; but among the important steps to be taken, both in accelerating recovery and preventing future trouble, is certainly the one advocated in this editorial—that is, that new equipment should be bought and installed annually to approximately the same value as the depreciation written off each year. If that were done, it is obvious that we would not have the severe fluctuations in the machinery industries that we have had; and if we did not have these severe fluctuations in the machinery and the so-called "capital goods" industries, we would not have them in the consumer industries either. I am almost inclined to say: "There ought to be a law."

OBSERVER

More—Not Less—Production is What We Need

The reference in December MACHINERY, page 232, to operating a plant under a code brings to mind the broader application of present governmental policies that, as an engineer, the writer believes should be generally understood. We cannot promote prosperity or national well-being by destroying wealth. We cannot raise the standard of living by plowing under cotton crops. We cannot increase the national wealth by paying farmers for not cultivating their land. We cannot raise the standard of living by working shorter hours and refusing to use improved machinery.

The only way that prosperity can be permanently promoted is by producing more, so that there is more to be shared by all. That is the fundamental principle of all economic progress. By that principle the value of every economic theory may be tested.

Let us all work together to devise a plan whereby the standard of living can be raised by increased production of all the things that we need, and by a more equitable distribution of these products.

PRODUCTION ENGINEER

* * *

Of the motor cars imported into Switzerland in 1933, nearly one-half came from the United States, while Germany contributed about 25%. France, Italy, and England accounted for the remainder.

Reducing Tool Costs with Arc-Welded Construction

Production in the Machine-building Industries has been Greatly Facilitated by the Use of Arc-Welded Tools and Jigs

By L. E. FULLER, Tool Engineer
Brown & Sharpe Mfg. Co., Providence, R. I.

HOW to produce accurate jigs and fixtures at a minimum cost is one of the great problems confronting manufacturers today. Unquestionably, the use of arc welding can be of great assistance in the solution of this problem. Production equipment of this kind can be made by arc welding at a lower cost than is possible with cast construction, which requires patterns, core-boxes, and molding facilities. Arc welding is also the quickest way to make jigs and fixtures. In some cases, from two to three weeks' time has been saved in the production of large jigs by employing arc-welded construction.

Before making a tool, most manufacturers calculate its cost and the saving that it will effect in a specified time. With arc-welded construction, the manufacturer can afford to have many tools, the cost of which was prohibitive before the introduction of arc welding.

The designer of a machine should endeavor to have each part made with the least possible amount of tool equipment. Whenever tools, fixtures, etc., are necessary, they should be made by the arc-welding method. Accordingly, the design should be made to lend itself to this type of construction, although this is not absolutely necessary, as not a single part has been found so far that could not be tooled by the arc-welded method at the plant of the Brown & Sharpe Mfg. Co.

Examples Showing the Flexibility of Design Obtainable by Arc Welding

Some of the arc-welded jigs shown in the accompanying illustrations would be difficult to machine if constructed in the usual way. A question that often comes up is: "How large a tool can be made by arc welding?" The jig for drilling milling machine stands, shown in Fig. 1, serves as an answer to this question. This jig is larger than any ordinarily required in the average machine shop. The limit in size, however, has not yet been reached.

In Fig. 2 is shown a box type of drill jig for a gear-case in which the center distances are held to close limits and the accuracy of the holes, with respect to size and alignment, must meet the requirements for roller bearings. Fig. 3 illustrates a jig made by arc welding, which could not possibly

Fig. 1. Arc-welded Jig of Large Size Employed in Drilling Milling Machine Stands

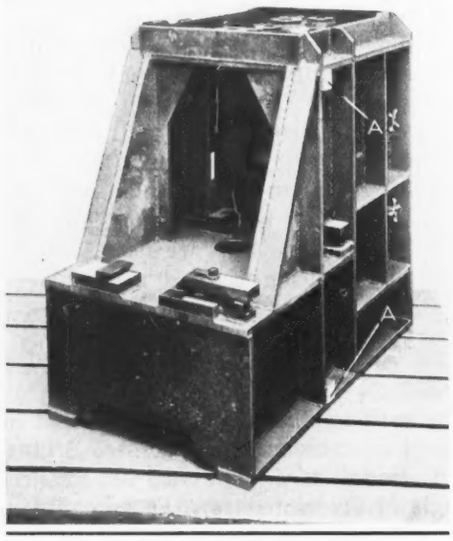
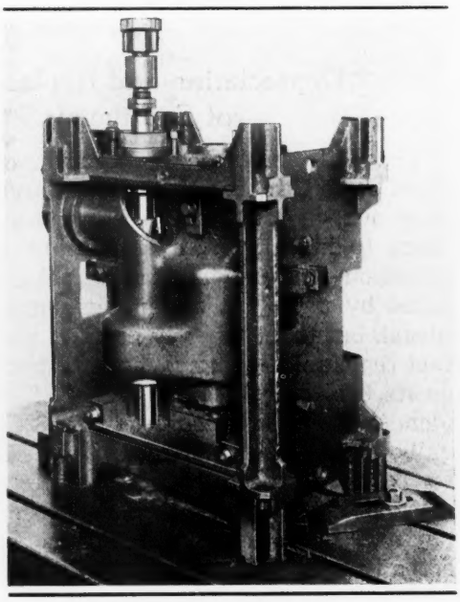


Fig. 2. Box Type Jig of Welded Construction for Drilling Gear-case

Fig. 3. Jig of Welded Construction that would be Difficult to Produce by Casting



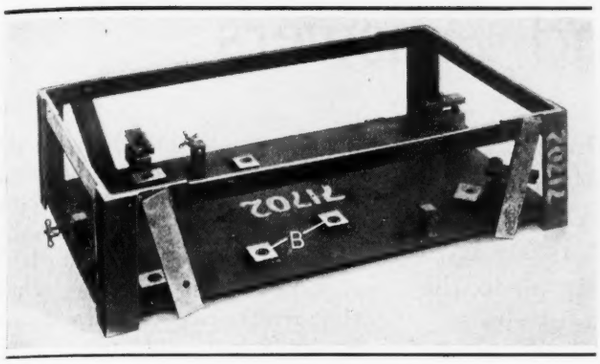


Fig. 4. Jig Constructed of Flat Plate and Angle-irons Assembled by Arc Welding

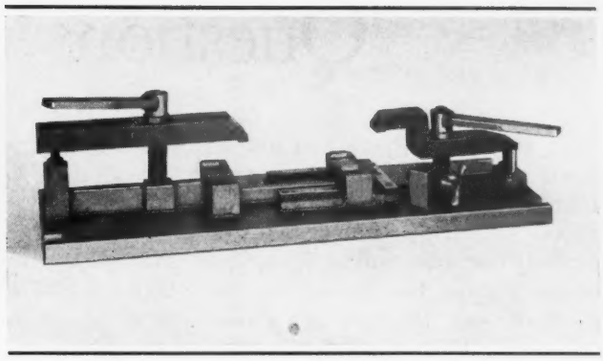


Fig. 5. Fixture with Steel Blocks Welded in Place to Give Added Strength and Weight

be made of cast iron with the construction details shown. This illustration shows how strips and angle-irons can be put in where they are most needed for rigidity. Patterns with tie pieces of this kind could not be drawn out of the molding sand; hence, such designs could not be made by casting. If redesigned to permit casting, the tool would have to be made much heavier.

In Fig. 4 is shown a jig of the flat plate and angle-iron type, which can be made up quickly to meet any small-job requirement. From an examination of the arc-welded jigs illustrated, it is evident that the machining requirements have been reduced to a minimum; also the jigs can be made strong and still be light in weight. Where weight is required in present-day milling fixtures, it can be obtained by arc-welding in steel blocks to give extra strength with the necessary weight.

Construction Details to be Considered in Designing Jigs

The design of a production tool depends largely on the accuracy required; this is generally determined by the tool designer. The tool must be so constructed that these limits can be readily maintained, thus assuring accurate machine parts. The production, or the number of pieces made in a year, will also have a direct bearing on the design of the tool. For example, a tool that is used for only a few hundred pieces a year would probably have ordinary clamps and clamp-screws for holding the work, whereas one used for several thousand pieces should have such features as quick-acting clamps, air-operated locking or holding devices, etc. The fixtures should have hardened wear-resisting surfaces.

In order to make the greatest saving possible in tool cost, the structural steel shapes now available on the market should be employed, as they can be readily arc-welded. A good bead weld usually possesses sufficient strength to withstand the average requirements of this work. All arc-welded tools should be heated to about 1300 degrees F., before machining, to relieve any strains set up in the plates and angle-irons by the welding operation. Small pads or spots, such as shown at *A*, Fig. 1, and at *B*, Fig. 4, should be placed at advantageous points to eliminate unnecessary machining of large surfaces.

* * *

Supervisory Agency for the Machine Tool and Equipment Distributing Trade

The supervisory agency of the code adopted by the machine tool and equipment distributing trade has been elected and is composed as follows: J. W. Wright, Colcord-Wright Machinery & Supply Co., St. Louis, Mo.; J. Roy Porter, Marshall & Huschart Machinery Co., Chicago, Ill.; Marshall Prentiss, Henry Prentiss & Co., New York City; Stanley Motch, Motch & Merryweather Machinery Co., Cleveland, Ohio; W. S. Dyson, Hallidie Machinery Co., Seattle, Wash.; C. E. Moore, Herberts-Moore Machinery Co., San Francisco, Calif.; G. H. Cherrington, Brown & Zortman Machinery Co., Pittsburgh, Pa.

* * *

That there is need for wholesale purchase of modernized equipment is well known. Manufacturers have bought the irreducible minimum during the last three years. If, let us say, only $5,000,000,000 is a normal annual machinery bill, we can assume that at least $10,000,000,000 worth of new capital goods are needed to bring manufacturing plants up to a fair degree of efficiency. Then, too, the purchase of capital goods in large quantities has a much better psychological effect than the purchase of an equal amount of consumer goods. How to get manufacturers to buy is the problem. It may be that the solution will be found in a plan of long-term credits yet to be evolved. Besides formulating fair trade codes in the capital goods industry, the Machinery and Allied Products Institute is analyzing every possibility that may start this much needed revival of machinery and equipment purchases.—*John W. O'Leary, President, Machinery and Allied Products Institute*

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

E. H. S.—We have had some controversy regarding the commercial tolerances on steel sheets of various finishes. According to some authorities, it appears that the limits on a sheet of, say, 12 gage, are plus or minus 0.010 inch. In some cases, such a large tolerance causes a great deal of difficulty in drawing-die work. Have standard tolerances been adopted for the thickness of sheets?

A.—The Youngstown Sheet & Tube Co., Youngstown, Ohio, has published a booklet entitled "Uniform Extras and Deductions under the Code of Fair Competition" for hot- and cold-rolled sheets of various finishes. The data in this booklet has been compiled with a view to assisting purchasers in writing specifications that will insure obtaining material having as nearly as possible the desired dimensions. This booklet includes standards approved by the board of directors of the American Iron and Steel Institute, September 20, 1933, as well as approved revisions effective December 1, 1933.

Material for Clutch Pins

O. E.—Difficulties encountered with breakage of clutch pins prompts this question: In a heavy coin press running at 125 revolutions per minute, the gear drive has been converted to a flywheel drive. The clutch pin used for starting the press is made from a 0.60 per cent carbon steel with low percentages of chromium and nickel. The high speed causes undue breakage of these pins. The pin is slid through a hole in the shoulder of the crankshaft and one end engages the driving member of the flywheel. This is the part that fails. What material would be recommended for these pins to secure longer life?

Answered by "Nickel Steel Topics," International Nickel Co., Inc., New York City

We feel that a more highly alloyed steel than the one you are now using for the pins in question is necessary to resist the severe service conditions which you described. Our recommendation would be a nickel-chromium-molybdenum steel of the following approximate composition: Carbon, 0.50 per cent; manganese, 0.65 per cent; nickel, 2 per cent; chromium, 0.90 per cent; and molybdenum, 0.25 per cent.

This steel has been highly satisfactory for services in which ductility is required, in combination with high hardness and fatigue resistance. With somewhat lower carbon and alloy content, the same steel has been widely used for aviation engine crankshafts.

The recommended carbon content is somewhat lower than that which you are now using, but hardness will be maintained because of the added alloy. The steel should be oil quenched at from 1475 to 1525 degrees F. It should not be tempered above 400 degrees F. As an alternative and tougher steel, we suggest SAE 3340, which contains: Carbon, 0.35 to 0.45 per cent; manganese, 0.30 to 0.60 per cent; nickel, 3.25 to 3.75 per cent; and chromium, 1.25 to 1.75 per cent.

If you feel that your present hardness must be maintained, the carbon range should probably be raised to from 0.45 to 0.55 per cent. This is an extremely strong, tough, and dependable steel, but, due to its air-hardening properties, will be found somewhat more difficult to machine. It should be oil quenched from 1450 to 1500 degrees F. and tempered not above 400 degrees F.

Properties not quite so good as those developed in the steels recommended, but still offering an improvement over your present steel, are shown by SAE 3250 which contains: Carbon, 0.45 to 0.55 per cent; manganese, 0.30 to 0.60 per cent; nickel, 1.50 to 2.00 per cent; and chromium, 0.90 to 1.25 per cent. This steel should be oil quenched at from 1425 to 1475 degrees F. and drawn at not over 400 degrees F.

Contract Containing Clause Not in Accordance with Facts

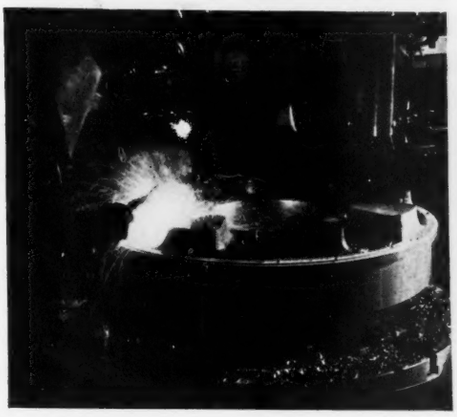
P. R. P.—Recently I leased a machine for one year. I paid $300, but the contract stated that I paid "one dollar and other considerations." The lessor has violated his agreement and I intend to sue him. Can I prove that I actually paid $300?

Answered by Leo T. Parker, Attorney at Law, Cincinnati, Ohio

When the evidence shows that a statement or clause in a contract is not true, this testimony will be considered by the Court in determining the rights of the litigants. For instance, in a leading case (280 Pac. 211), it was disclosed that a person purchased a valuable plant and paid $5000 for it. However, the contract provided that the consideration paid was "one dollar and other valued consideration." The Court held that the purchaser was entitled to prove the exact purchase price.

Welding on the Spot

Often, in machining a steel casting, a small blow-hole or other defect appears. When this happens on a finish cut, it is a very expensive operation to remove the casting from the machine and have it repaired and reset. At the East Pittsburgh Works of the Westinghouse Electric & Mfg. Co., this is handled by having a welder come to the machine and repair the casting without removing it from the fixture.



Casting Repaired by Welding without Removing it from the Machine

The time for repairing the casting shown in the illustration was ten minutes. Three and one-half hours for removing the casting from the machine and setting it up again were saved by welding it in place.

It Was Ever Thus...

"There is scarcely anything around but ruin and despair." (William Pitt in 1795) "In industry, commerce, and agriculture there is no hope." (Disraeli in 1849) "Almost all railroads defaulted in the interest on their funded debt and fifty thousand commercial houses failed in the United States in 1873 - 1878." "One hundred and sixty-nine railroads failed in the United States in 1893."

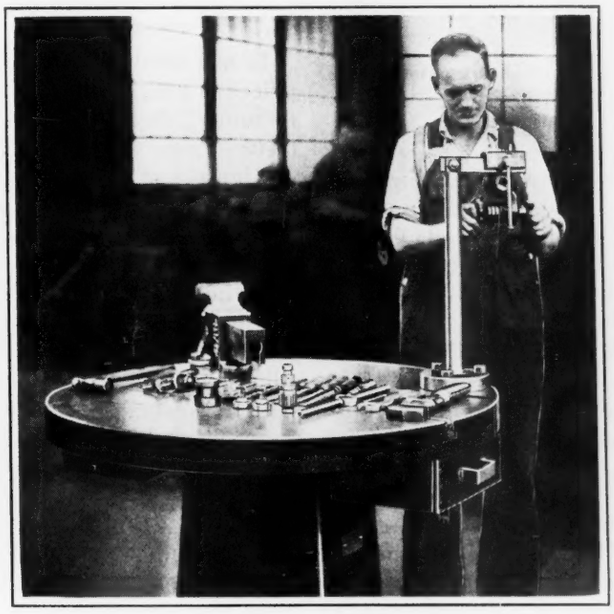
Each time that the world has recovered, national well-being has reached greater heights than previously. Only he who knows nothing of history would believe that we cannot surmount our present difficulties.

* * *

Swiveling-Top Work-Tables Speed up Air-Brake Repairs

Work-tables having tops that can be swiveled with ease around a central journal or hub are used extensively in the air-brake repair department of the Canadian National Railway shops at Stratford, Ontario. Several vises and other holding appliances can be bolted to these table tops as illustrated. If the machinist wishes to place the unit in a different holding device or reach a tool on the opposite side of the table, no steps are necessary. He need only give the table top a slight push to bring the device or tool to him. Another important feature is that the man can always position the table so as to take full advantage of the best light.

The table top is an iron casting having the journal integral. The journal is 4 1/2 inches in diameter by 5 1/4 inches long and fits a hole bored in the top of the pedestal. The table top measures 45 inches in diameter and is at a height of 33 inches above the floor. Sheet-metal tool drawers are fastened to the under side of the table. A door gives access to the inside of the pedestal leg, where other tools can be stored. C. O. H.



Work-table with Swiveling Top

* * *

Heavy Road Machinery Parts Quickly Delivered by Plane

When work was halted on the California-Nevada Highway because of the breakdown of a paving machine, the air express was called upon to rush a shipment of repair parts weighing 255 pounds from the plant of the Nordberg Mfg. Co. in Milwaukee to Reno, Nev. As soon as the breakdown occurred and the damage was examined, a wire was sent to the manufacturers who, the same evening, dispatched the required parts. The shipment was received at Reno the following evening, after a flight of about 2000 miles. By seven o'clock the following morning all repairs had been made and the construction work was continued. Two full days were saved by handling these machinery parts by plane.

* * *

The industrial and economic problems that face this nation are intricate and difficult; but, if we are willing to grapple with them with the same clear mind and the same freedom from prejudice that characterize the engineer when he attacks a mechanical problem, we will succeed in solving them.

The Importance to Industry of a Definite Price Policy

From a Statement Presented at the Public Code Hearing in Washington by Herman H. Lind, Member of the Code Authority for the Machine Tool and Forging Machinery Industry, and General Manager of the National Machine Tool Builders' Association

THE suggestion has been made within the last few days that buyers group themselves together to get the advantages of group action. May I point out that the buyers today, buying for large and concentrated concerns, such as mail-order houses, department stores, chain stores, and some of the large manufacturing companies, do have that advantage? It might not be such a bad idea for all of these buyers, both the large and the small, to get together under a Code of Fair Competition, and, among other things, provide that it be construed as an unfair trade practice to divulge, or even to intimate, to any supplier the prices, terms, and conditions offered by that supplier's competitors. They might also use the Code to outlaw the pirating of engineering or style designs, or assisting others to pirate such designs.

The National Recovery Act was written and passed with the clear intent of enabling industries to work together in an effort to bring back fair wages, fair working conditions, fair trade practices, and prices under which industry might live. Published open prices are a means to that end. With the provision that there shall be no deviation from those prices, all customers will be treated fairly and without discrimination. Every buyer will know that no one else is buying from a given producer at a better price; consequently, his effort will be directed toward determining the real value of the product in proportion to the price offered him, instead of toward chiseling down the prices of hungry competitors.

Sufficient Time for Notice of Price Changes is Necessary to Prevent Making Price Change a Subterfuge for Price Cutting

In all these discussions, consumer goods have received much emphasis. Let us consider for a moment durable goods, such as machinery and all sorts of equipment, where individual manufacturers determine and establish their own prices by listing them with their Code Authority, their trade, and their competitors. Through this method, if a manufacturer sets his price too high, he loses business; if he sets it too low, he loses money. If he has reason to increase or decrease his price, sufficient length of time should be given his trade and his competitors to know that a change will be made; also, to insure that the price change is a matter of policy and not a matter of temporary expediency for some immediate advantage.

An insufficient period for notice of price change for this type of equipment, in my opinion, would wreck the firm price policy which is so necessary to the continued life of these industries, and would put them right back where they were a year ago, forced to make lower and lower prices in order to meet progressive price cutting. It would give a few powerful buyers, who proved to be the best traders, a more favorable price than others could obtain. The seller, when he felt he had the inside track, might raise his price for a specific order and then drop it again, to the disadvantage of some customers.

The open price policy can be effective in maintaining firm prices only by providing such time for notice of change in price as to eliminate the use of instant change of price as a subterfuge for price cutting.

The Publication of Prices Does Not Promote Price Fixing

It has been claimed that the open publishing of prices is resulting in unfair and illegal price fixing in some industries. If this is true, there are protective laws which provide plenty of power to investigate and prosecute the wrong-doers. The withdrawal of open price provisions, or the elimination of the period of notice of change of prices, will not stop price fixing where it now exists. The benefit that the National Recovery Act offered to industry was the possibility of making the firm price policy practical in operation through the ability to enforce adherence to a price once established, while at the same time encouraging a seller to change his prices as freely as his market requires. To eliminate this privilege, would take away from industry all hope for the fair and honest business methods promised under the Act.

In the industries of the consumer goods type or those nearer the raw material stage, particularly those that are subject to rapid fluctuations in the prices of their raw materials, it may be practicable

to provide for very short notice of price changes. Very often the prices of these products are a matter of a few quotations rather than whole series of lists to cover a multitude of lines, types, and sizes. Those industries have been accustomed to quick price changes; but, even in these industries it should be incumbent upon the seller to make known his new price, whether higher or lower, and to accept all orders offered to him at that price.

What About Discriminatory Prices to Favored Customers?

The National Industrial Recovery Act specifically provides against fostering of monopolies, and all codes include that as one of their provisions. It should be recognized not only that promotion of monopoly is possible between competitors, but that monopoly in the past has been fostered to a great degree by discriminatory prices to favored customers.

The so-called "back-log" orders are illustrative of this; that is, the practice of taking a few orders for a large quantity of goods at greatly reduced prices, without profit or even at a loss, with the expectation of making up the loss from sales to other customers at higher prices. This is a practice that should be outlawed. It is unfair; it discriminates particularly against the smaller enterprise. It gives the favored buyers monopoly advantages. The firm price policy would make all this impossible.

In the equipment industries, the immediate advantage of the firm price policy on standard products and of the one-and-last-price policy on special products would save a tremendous amount of money to both buyer and seller.

The Real Salesman Comes into His Own where Firm Prices Prevail

How many times do we find a salesman called back on the same negotiation, each time for the purpose of getting him to shave some more off his price? And, sadly enough, under this condition many salesmen have put greater effort into selling the buyer the idea of giving him a chance to get another "crack" at the business than into selling the quality of his product and the service of his company.

Compare this with the situation under a policy where the buyer knows that the price he gets is the only price he can get. He then puts his entire attention on evaluating the relative merits of the product offered him against the known prices, and chooses according to his best judgment. Should he know of a specific product he wants to buy, he is perfectly safe in placing his order by wire or by mail, knowing that he will pay no more than any competitor—and no less; because under the firm price system of establishing and listing prices, the records are completely open to any buyer, as well as to competitors. Under such a system, each manufacturer establishes his own price, and it is an honest price—one on which he is willing to stand or fall without subterfuge, misrepresentation, or discrimination.

The Firm Price Policy is Not a New Experiment

Everyone recognizes the advantages to both customer and seller of the price policy of the department stores and the chain stores. Is it not obvious that a similar definite price policy would be of advantage throughout industry?

The National Recovery Act was drawn and passed in order to place industry in position to establish rules of fair business conduct, the Government to be the arbiter in their formulation and the referee of their operation. The firm price, open price policy is the most important rule of all. It is the only honest way of doing business. It is fair to everybody; it is square; it eliminates waste; it creates confidence. Is it not wise then to encourage the efforts that industries are making through their codes to have this policy adopted as a universal practice?

* * *

Advantages of Photostats in Reproducing Blueprints for Publication

By W. F. SCHAPHORST

Few manufacturers seem to know that blueprints can be reproduced for use in publications such as catalogues. The usual method is to make an entirely new drawing in black ink on white paper. This procedure is expensive—so expensive, in fact, that it is not followed by those acquainted with the economy of using photostats.

The writer has reproduced blueprints frequently without inking a single line. The print is sent to a concern specializing in making photostats, the required size being specified on the order. The minimum size photostat is 8 1/2 by 11 inches, and costs only 25 cents. The photostat copy is a so-called "positive"; that is, the lines are black and the background is white. A first-class photostat will have well defined black lines which can be reproduced in the line-cut without difficulty.

* * *

An Unbreakable Hacksaw Blade

A hand hacksaw blade that is guaranteed to be unbreakable in regular use is made by the Diamond Saw & Stamping Works, Buffalo, N. Y. It is known by the trade name of "Super-Sterling." The entire blade is made of high-speed steel. The teeth are of maximum hardness and toughness at the cutting edge. Below the root, the degree of hardness tapers gradually giving a resiliency to the body of the blade that makes it unbreakable.

Shaper Attachment for Machining Tools for Relieving Milling Cutters

By JACK FINLAY, Assistant Manager
Small Arms Factory, Lithgow, New South Wales, Australia

IN Fig. 1 is shown an attachment for automatically raising a shaper tool at the end of its cutting stroke and lowering it again at the beginning of the next cutting stroke. This prevents the tool from dragging on the work during the return stroke. In addition to raising the tool so that it clears the work on the return stroke, the attachment has an automatic feed that advances the tool for each cutting stroke. This attachment has been used satisfactorily for the last nine years in making relieved formed tools, some of which are 4 1/2 inches wide. These formed tools are employed for relieving milling cutters.

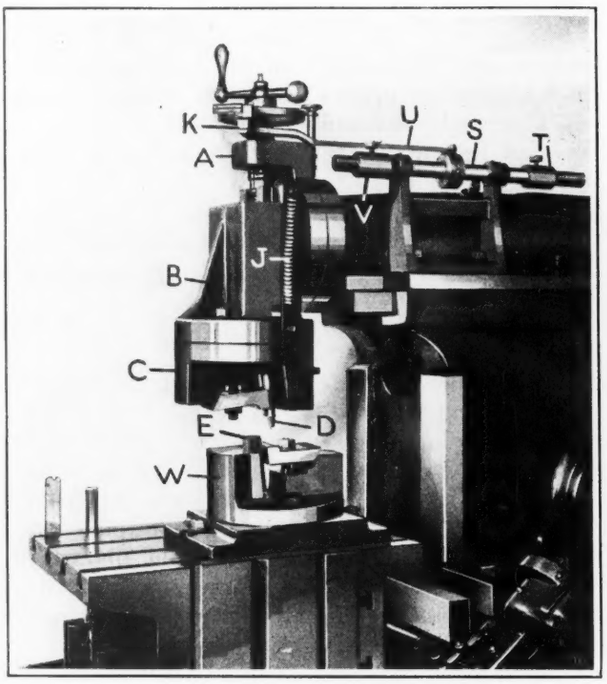


Fig. 1. Shaper Equipped with Attachment for Machining Formed Tools Used in Relieving Milling Cutters

The head casting *A*, Figs. 1 and 2, is fitted to the ram of the shaper. On the return stroke, the dovetail slide *B*, mounted on casting *A*, is normally held in the upper position by means of two helical springs *J*. At the beginning of the cutting stroke, the feed-screw *F* is forced down to bring the tool into the cutting position by automatically turning the cam-bushing *H*. The cam-shaped teeth on bushing *H* and those on bushing *G* mesh with each other and serve to force the feed-screw *F* downward without imparting any rotational movement to it. At the end of the cutting stroke, the cam *H* is turned back to its original position, so that the tool is raised to clear the work by the action of springs *J*. The downward feeding movement for each new cut, however, is obtained by rotating the feed-screw *F* automatically and independently of the vertical movement obtained by the cam-bushings *G* and *H*.

The tool-holder *C*, Fig. 1, is bolted to the lower face of slide *B*. In this tool-holder is held the master tool *D* for shaping the formed milling cutter *E*. The hardened cam-bushing *G*, Fig. 2, which has tapered slots or teeth cut in its face, as mentioned, is fitted in casting *A* and is prevented from turning by a key *R*. The cam-bushing *H*, with its shank passing through bushing *G*, has tapered slots or teeth that mesh with the latter member. The screw *F*, which feeds the shaper tool to the work, passes through cam-bushing *H*, which is held in a vertical position by means of the ball thrust bearings. Cam-bushing *H* is moved to and fro about 1/6 revolution to produce the vertical movement of the tool required to insure clearing the work on the return stroke. The mechanism for moving cam-bushing *H* is bolted to the ram of the machine, as shown in Fig. 1.

The screw *F* carries an index-plate of 200 divisions, and as the screw has five threads per inch, each division represents a movement of 0.001 inch. The actuating arm *K* carries two pawls *L* and *M*, one being set one-half division ahead of the other, so that a feed of 0.0005 inch per stroke can be used, if necessary. Thus the mechanism can be set to feed the tool downward any desired amount at each stroke, in addition to withdrawing the tool from contact with the work on the return stroke.

As the shaper ram moves forward, the sliding shaft *S*, Fig. 1, in the bracket on top of the machine moves forward. When the tool has finished cutting, the movement of this shaft is stopped by the collar *T*. As the ram continues to move forward, the link *U*, attached to shaft *S*, is held stationary. This moves the actuating arm *K*, which revolves the cam-bushing *H*, causing the tool-slide to be raised. As the ram nears the end of the return

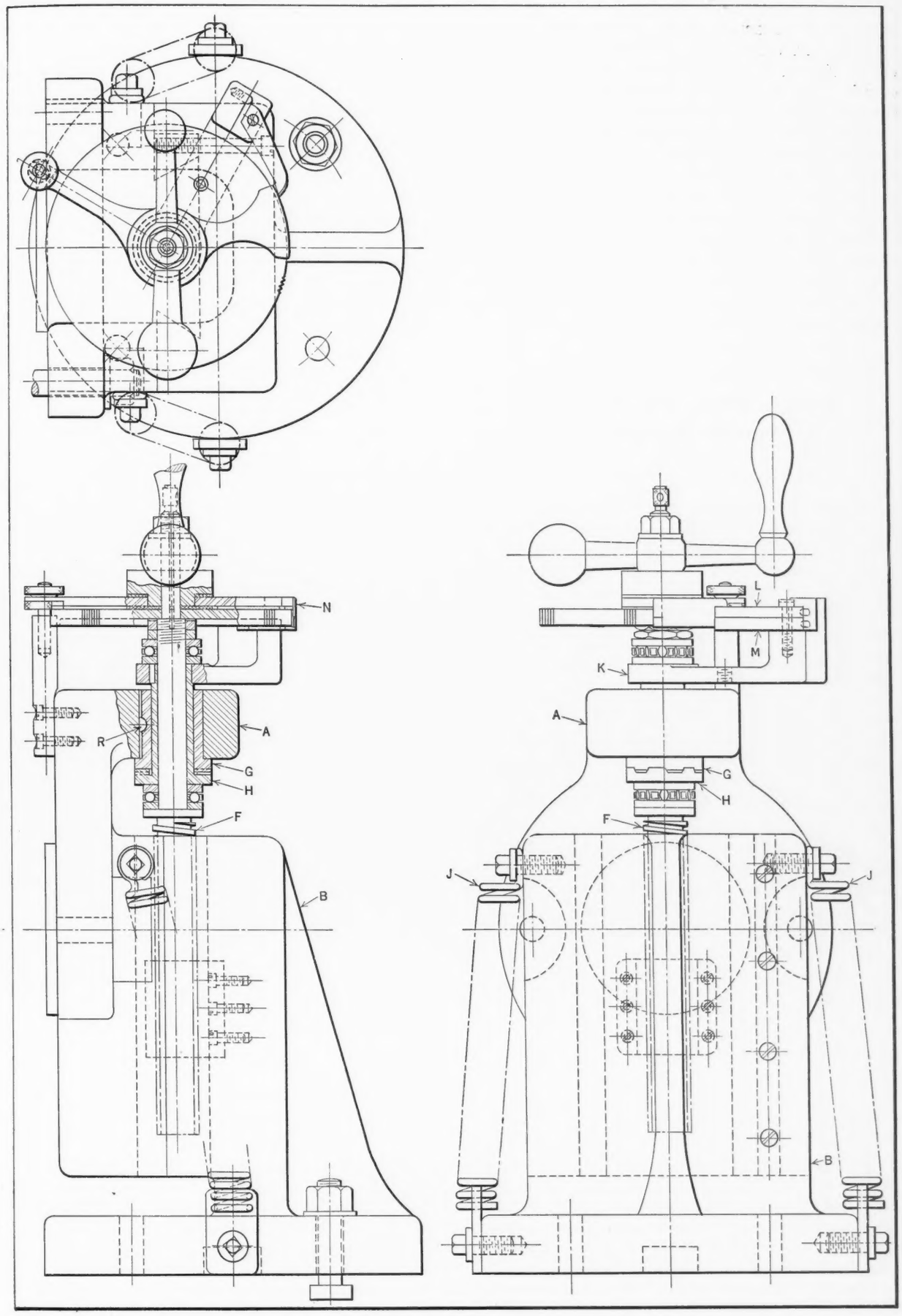


Fig. 2. Shaper Attachment that Automatically Raises the Tool from Contact with the Work on the Return Stroke

stroke, the movement of the sliding shaft, which is traveling in the reverse direction, is arrested by collar *V*, and upon further movement of the ram, cam-bushing *H* is again revolved, bringing tool *D* down once more into the cutting position.

A mask or cover for regulating the amount of feed of the pawls at each stroke is shown at *N*, Fig. 2. The tool-holder *C*, Fig. 1, can be set so that the formed tools can be relieved at any angle required. Insert pieces can be employed to locate the master tool at any desired angle. The holder *W*, mounted on the shaper table for holding the tool *E* to be formed, is similar to holder *C*. Tool-holders *C* and *W* are always set to the same angle when relieving tools at an angle.

* * *

Toggle Press for Power or Hand Operation

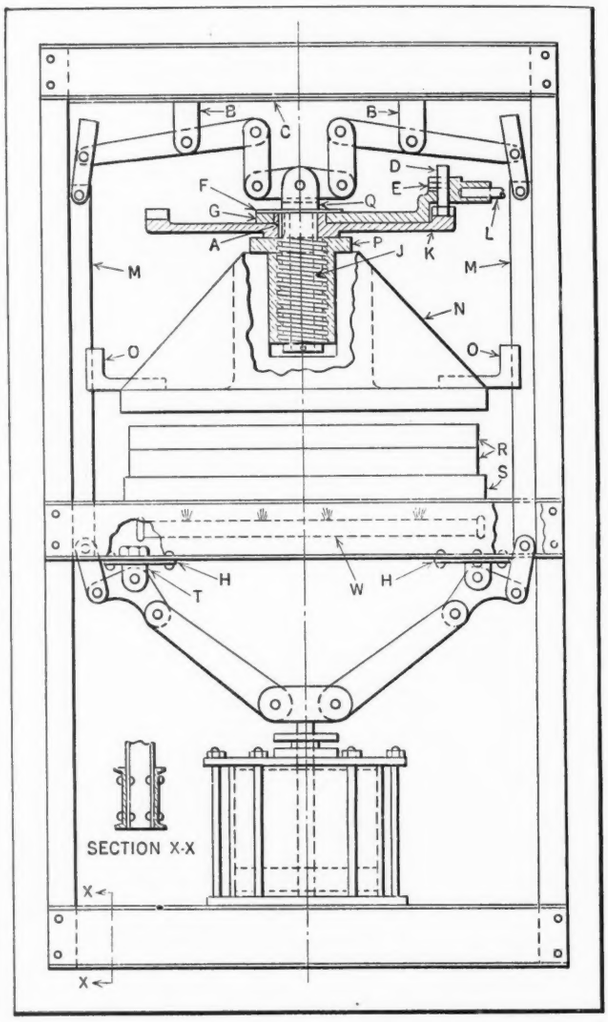
By STANLEY EDWARDS

The power toggle press shown in the accompanying illustration was designed for the heat-treatment of narrow strips of raw cork under pressure, but it can also be used for molding or other operations requiring the application of pressure either with or without heat. When removed from the die, the treated cork strips retain their compressed density and are ready to be placed at the bottom of piston-ring grooves.

While the stroke of this press is limited to about 1 inch, the space between platens *N* and *S* can be regulated to accommodate dies *R* of different thicknesses by adjusting screw *J*. The press can also be operated by hand in the same manner. The side and cross members of the frame are constructed of channel iron, as shown in section *X–X*. All links are made of cold-rolled steel. The piston-rod is made from a forked steel forging, and the cylinder consists of a piece of extra heavy wrought-iron pipe, bored and ground. The cylinder heads are of the plain flange type, the upper head being provided at first with a stuffing-box which was later found unnecessary, as the weight of the piston and links overbalanced the weight of platen *N* sufficiently to return it to the upper position. This feature made it unnecessary to admit air to the top of the piston.

The side bars *M* are made of square cold-rolled steel; the two guide castings *O* are machined to fit these bars and are secured to the top platen by cap-screws. The top platen *N* is of the hub and rib type, the hub being bored to receive the bronze nut *P*. This nut is secured in place by screws that pass through its top flange. Screw *J* is bored to receive the stem *Q* and is also provided with a hub to which the casting *K* is secured by key *A*. Casting *K* is provided with ratchet teeth on its top flange. Ratchet casting *G* is bored to a working fit on the top head of casting *K* and is also provided with a ratchet pin *D* and a pocket in which to insert the operating bar *L*. Casting *K* is held in place by washer *F*, while the forked stem *Q* is held in place by a collar at the lower end of nut *P*.

When the ratchet casting *G* is not in use, pin *D* can be lifted and held out of mesh by the pin *E*. The space between the platens can be adjusted quickly by operating casting *K* by hand. Should the power fail, the press can be operated by hand by inserting bar *L* and dropping pin *D* into place. Links *M* are provided with an extension at the top end which comes in contact with plate *C* a short time before the piston reaches the top of its stroke. This prevents damage to the press in the event that the power is turned on when there are no die-



Toggle Press Equipped with Gas Burner for Heat-treating Cork under Pressure

blocks *R* in the press. The actuating power—in this case compressed air—is controlled by a three-way valve which exhausts into the atmosphere when the pressure is released. Plate *C* is riveted to the lower flanges of the upper cross members to provide a guide for the castings *B*. Plates *H* are riveted in the same manner to provide bearings for the forked studs *T*. The gas burner *W* was placed under the bottom platen.

Turning the Spot-Light on the Recovery Policies

In a Thought-Provoking Address before the Code Authority Conference in Washington, Ralph E. Flanders, President of the Jones & Lamson Machine Co., and a Member of the Industrial Advisory Board, Points to Certain Fallacies in Our Recovery Program and Advocates Better Distribution — Not Less Production — of the Goods of Industry

THERE is no doubt about the question as to whether there has been a business recovery. As compared with a year ago, or with two years ago, the various indices show a marked improvement in general conditions; and there are few of us whose individual business figures do not tell the same story.

The improvement is not entirely one of statistics. There is also abroad a feeling of courage and hope which makes the best possible background for further advances. This sentiment, generated by President Roosevelt in the unforgettable first weeks of his administration, still persists as effective influence. It is perhaps the most solid constructive factor of the present day.

Statistics of business operation and basic sentiment are both favorable. The unfavorable element is the mass of unemployment still remaining. Until the early fall there was hopeful progress in getting men back to work. Then the employment figures stopped their advance and began to recede. Not yet has the loss been made good in private industry. The gains have been made in work financed by public money, either through the tardy development of the PWA program, or by the hastily organized CWA.

The Resources of this Nation Make Full Employment Permanently Possible

Leaving aside the business implications of this condition, let it at once be said that business men must not and do not rest content with this inadequate measure of re-employment. The resources of this nation, the character and capacities of its inhabitants, and the organizing genius of our capitalistic system are such as to make possible full employment, a high and rising standard of living, a better distribution of that standard, and an increasing progress in protecting it from severe fluctuations. American business will never rest content with the present situation from the human standpoint, let the statistical improvement be what it may be.

What are the remedies immediately at hand for improving employment? The two that have been urged most strongly are the setting up of unemployment reserves, and a further general shortening of hours.

There is much to be said for a national or universal state system of unemployment reserves, such as is provided in House Bill 7659. Any careful study of this or similar proposals would lead to critical as well as to favorable comment. But it is self-evident that there is no intention or possibility of making this policy effective for the immediate emergency, and we must look elsewhere for hopeful lines of action.

The Shortening of Hours is Not the Road to a Higher Standard of Living

The second proposal, a further general shortening of work hours, cannot be dismissed so easily, as an emergency measure. A detailed study of this proposal leads to certain conclusions which can be given only in condensed form in the brief time allowed. Those conclusions are:

1. As the President has clearly brought out, shorter hours without a rise in wage rates obviously is not a recovery but a relief measure, in which the workmen previously employed relieve those who are re-employed under the new schedule. This would be a severe blow to those who are just beginning to get ahead with their old debts.

2. If adjustments are made, the net results will vary with the proportional changes made in wage rates, prices, and profits; but there will result a lowering of the industrial worker's income measured in goods he can buy, owing to diminished wages and/or higher costs and prices.

3. The increased costs arising from shorter hours will of necessity require some price increases. There is no assurance that those price increases can be kept within the limits of absolute necessity. Most products pass through numerous hands before reaching the consumer. There are tens of thousands of products and hundreds of thousands of separate transactions on which new prices must be fixed. There is bound to be some pyramiding of costs. This will further increase the spread between agri-

cultural and industrial prices, thus defeating one objective of the recovery program.

4. The lowering of wages and salary incomes and of profits and/or the increase in prices will choke the rising employment in industries furnishing luxuries, services, durable consumer goods, and capital goods; since these are the depressed industries, the policy will seriously hinder recovery.

5. While we are concerned with statistics as to persons employed, a *real recovery will be measured by the production on a larger scale of more goods, and a broader distribution and enjoyment of them;* shorter hours limit production, distribution, and enjoyment of goods and are thus a bar to recovery.

6. The change from forty-eight or fifty hours a week to a standard forty-hour week is a serious drop which has not yet been assimilated. With not enough goods made even in 1929 to provide a desirable standard of living to the workers of the country, the raising of that standard under a forty-hour week will be difficult. With appreciably shorter hours, it will be impossible.

The Spreading of Work by Shorter Hours is Relief—Not Recovery

As a measure of spreading work during depression, general shorter hours has something to be said for it. As a measure of recovery, it is not merely ineffective—it is destructive.

But what about a selective shortening of hours in different industries by the code authorities? This can properly be done where a given industry meets a decrease in demand, and wishes by this means to spread work throughout the industry.

A particularly difficult situation exists in those industries in which recovery has not yet progressed to the point where employed workers can be worked at their maximum hours. Such industries have a serious problem to solve as to how living wages shall be paid without price raises which will choke further recovery. No general solution can be offered; each case must be considered and solved as a separate problem.

There are some industries in which a shortage of highly skilled help has appeared, even while common or less skilled labor is still available. Here a shortening of hours must be based on the conditions of the skilled rather than of the mass of employes. A further problem is presented by the great mass of local service industries, such as laundries, barber shops, and shoe repairing shops. In these cases, the solution must be narrower even than the industry basis. Only the local conditions of a region will determine whether shorter hours with higher wages and prices will decrease the demand for these services, so that an actual decrease of employment will result therefrom.

Lastly, it is difficult to see how a compensating rise in wages in an industry which shortens its hours for special reasons can have anything other than the harmful effects on recovery on a small scale that the general policy would have on a large scale, as already described. *It can only be hoped that general improvement will be sufficient to counteract the effects of these relief measures.*

Equitable Distribution—Not Less Production—Will Solve Our Problems

What then shall we do?

Perhaps we have been too hasty in seeking to discard the CWA. Perhaps what we need to do is to refine it and put it on a more sensible and satisfactory basis as a permanent institution, which shall give assurance that no industrial worker in this country, in good times or bad, shall go without useful work, at such wages as shall, on the one hand, insure him and his dependents food, clothing, and shelter, and on the other, give him the incentive to get back into private employment at the earliest opportunity.

Here again there is no time for a thorough analysis of a properly organized CWA. Let it be urged upon you, however, to give the idea sympathetic consideration. We are in what ought to be a normal and healthy recovery. We are more conscious of the remaining unemployment and more disturbed about it than ever before. What we have to do is to be certain that the measures taken to insure relief do not prevent recovery.

We are in danger of forcibly reorganizing our national life on a subsistence basis. What we must do is quite the opposite. We must encourage the growth of the service and luxury occupations which our civilization can so richly afford. Our thought and planning should then go to better distributing these goods—not preventing their production.

* * *

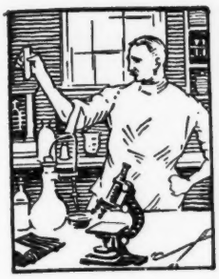
Objectives of the NRA

Commenting upon the objectives of the NRA, Philip E. Bliss, president of the Warner & Swasey Co., Cleveland, Ohio, summarizes the trends under the NRA as follows: (1) Fairer competitive practices under rules and regulations. (2) Prices more standardized, with greater emphasis upon the institutional side of advertising and selling. (3) Cooperative and educational selling and advertising efforts upon the part of whole groups of businesses, in an effort to broaden markets. (4) More efficient production with stabilized employment and wages and more intelligent use of machinery.

* * *

An interesting chart showing comparative commodity prices and building costs for the last eighty years has been published by the American Fore Group of Insurance Companies, 80 Maiden Lane, New York City. This chart can be obtained by applying to the organization mentioned.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

An Electric Furnace Alloy for Cast Cam- and Crank-shafts

"Proferall" is the name of an electric furnace molybdenum-nickel-chromium alloy made by the Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., for use in the manufacture of cast camshafts and crankshafts. Superior wearing qualities and physical properties are claimed for this material.

Laboratory tests have shown that the camshaft metal has a minimum tensile strength of 50,000 pounds per square inch. Other grades for crankshafts have a minimum tensile strength of 60,000 pounds per square inch and a maximum strength as high as 80,000 pounds per square inch. It is claimed that the method of making the molds and pouring the metal prevents internal shrinkage or distortion.

Bimetal Automatically Controls Gas and Electric Appliances

Upon the simple principle that metal expands when it becomes heated and contracts when it is cooled is based the control of electric refrigerators, automatic electric irons, toasters, thermostatically controlled oil burners, and many other automatic conveniences of the modern home. In industry, gas and oil furnaces, ovens, air-conditioning devices, etc., are likewise controlled.

This principle may be practically applied to devices and equipment of the types mentioned through the use of Bimetal, a product of the W. M. Chace Valve Co., Detroit, Mich. Bimetal consists of two strips of different metals joined together by riveting, brazing, or welding. One metal possesses a high coefficient of expansion and the other a low coefficient of expansion.

When exposed to a rise in temperature, the material with the high coefficient of expansion lengthens, so that the piece becomes bent. Then, if the temperature drops, this material shrinks to its original length and the piece is straightened out again. If a piece of Bimetal is subjected to a low temperature, it bends in the opposite direction and straightens out again when the temperature rises to normal. This bending action of Bimetal is utilized in various appliances to make an electrical contact and thereby start an apparatus for the purpose of correcting the condition of too much or too little heat.

Raw materials of many compositions are used in making Bimetal for the automatic control of devices at temperatures as low as 50 degrees F. below zero and as high as 1200 degrees F. Standard thicknesses range from 0.010 to 0.100 inch. While Bimetal is ordinarily made in strip and sheet form, it can be supplied in spiral or helical coils and in various other shapes to meet requirements.

Where the Name Nickel Came from

When European artificers of metal first tried to produce a useful metal from a zinc-bearing ore mined in Saxony, they experienced so much difficulty that they called the ore "Kupfer-Nickel," which, translated into English, means "The Devil's Copper." This was how nickel got its name.

What Stainless Steel is Best Suited for Dairy Equipment?

Few foods are so easily spoiled as milk and products of the dairy. For this reason, great care must be taken to insure that the metals which come into contact with milk during pasteurizing, storing, bottling, and other operations do not impair the taste or color. Stainless steels have been proved by chemical and physiological tests, as well as by actual service, to possess superior qualities for this purpose.

The question naturally arises as to which of the stainless steels is most suitable for the fabrication of dairy equipment. According to a bulletin issued jointly by the American Sheet & Tin Plate Co. and the National Tube Co., Pittsburgh, Pa., the alloy

popularly known as 18-8 (containing 18 per cent chromium, 8 per cent nickel, and the balance iron) has been found especially suitable for dairy machinery and equipment because of its immunity to corrosion, ease of fabrication, and moderate cost. It is available in various forms for constructing machinery, pipe systems, and tanks.

Ford's Experience with Dies of Alloy Cast Iron

Alloy cast irons have been used extensively by the Ford Motor Co. for sheet-metal forming dies and have in many instances proved to be better than the more costly steel dies, according to the *Nickel Cast Iron News*. Progressive dies for such small parts as head-lamp shells, which are turned out by automatic presses at the rate of from 1000 to 1200 pieces an hour, are made from a heat-treated nickel-chromium cast iron. This alloy is of the following composition: Carbon, 3.25 per cent; silicon, 1.25 per cent; manganese, 0.45 per cent; nickel, 2 per cent; and chromium, 0.70 per cent.

Dies made from this alloy are heated to 1500 degrees F., quenched in oil, reheated to 900 degrees F., and cooled in air. This treatment provides a hardness within the limits of 286 and 321 Brinell.

Incidentally, the same material, heat-treated as outlined, has also been found particularly satisfactory for guide blades in the centerless grinding of such parts as piston-pins, valve-stems, and push-rods, which must not be scored or scratched.

Large forming dies used for producing fenders, body sections, etc., were formerly made of ordinary cast iron. As they became worn, inserts of alloy die iron were provided to prolong their life. Such large dies are now made from an alloy cast iron of the following analysis: Carbon, 3 per cent; silicon, 1.45 per cent; manganese, 0.90 per cent; nickel, 3 per cent; and chromium, 0.90 per cent.

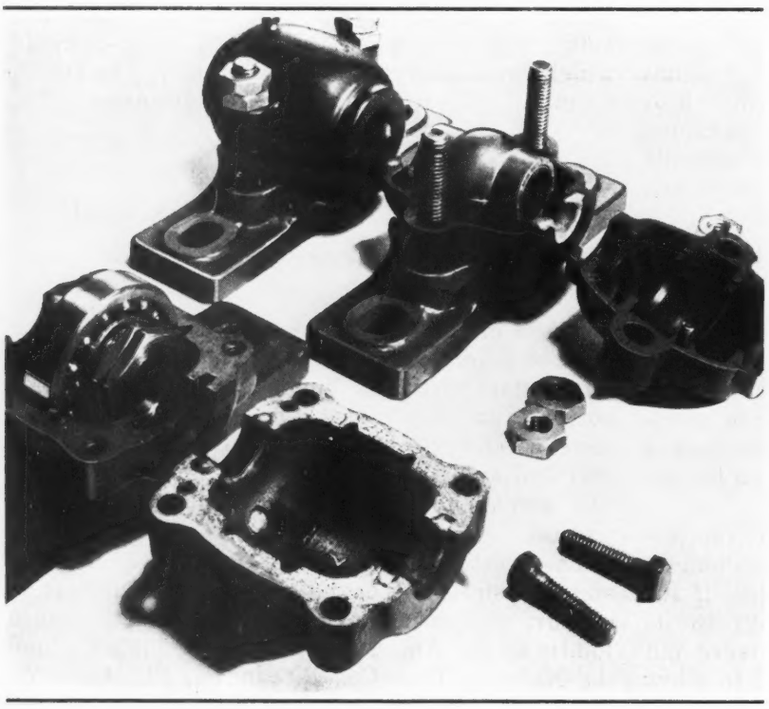
This analysis is used because the dies generally are too large to heat and quench with the usual equipment. They are allowed to remain in the mold until they have cooled completely. The hardness ranges between 280 and 300 Brinell. The machineability of these castings, while somewhat less than that of ordinary cast iron, is very good.

Both of the alloys here referred to are produced in the electric furnace, but it is said that very good die irons can be made in the cupola if reasonable care is taken to control the analysis.

Haveg—a Synthetic Resin Material for Pickling Tanks

Unusual acid-resisting properties are claimed for a synthetic resin material that is being placed on the market by the Haveg Corporation, Newark, Del., a subsidiary of the Continental-Diamond Fibre Co. This material will be found especially useful in the metal-working industries for constructing pickling tanks. It is a phenol-formaldehyde plastic.

Tanks up to 9 feet in diameter by 9 feet in height have been made from this synthetic resin material in a single piece without seams or joints. The material can be used at temperatures up to 265 degrees F., and it does not crack when cooled from this high temperature to the freezing point. In Germany, pickling tanks of this kind have been used over a period of years without failure.



Pillow Blocks are Die-cast from Zinc by the Walker Turner Co., Plainfield, N. J. In Addition to Both Halves of the Pillow Block, the Spherical Bushing of the Self-Aligning Type, Seen at the Top of the Illustration, is a Zinc Die-Casting. A Bronze Tube is Inserted in This Bushing to Support the Shaft—Photograph, Courtesy the New Jersey Zinc Co.

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.

Electrical Equipment

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Catalogue 33-200, covering the complete line of oil circuit-breakers made by this company. Leaflet 20530-B, descriptive of the Westinghouse line of explosion-resisting fan-cooled motors in ratings up to 200 horsepower. Leaflets 20604, 20605, and 20606, illustrating and describing, respectively, Type FR repulsion-start induction motors for high-torque, constant-speed service; Type FK direct-current motors for shunt-compound and series-wound service; and Type FS polyphase squirrel-cage motors—all of fractional horsepower size. Leaflet 20609, describing Type CR repulsion-start induction motors, especially designed for heavy industrial duty. Leaflet 20616, descriptive of the Ignitron welding timer for spot welding.

Noise-Measuring Equipment

ELECTRICAL RESEARCH PRODUCTS, INC., Subsidiary of Western Electric Co., 250 W. 57th St., New York City. Circular entitled "Practical Noise Measurement," descriptive of a noise meter that measures directly the loudness of a sound, expressing the result in actual figures. Pamphlet entitled "Acoustic and Noise Control," outlining the engineering service offered by the acoustic consulting department of the company in making noise surveys, sound analyses, suggestions for noise reduction, acoustic designing, and acoustic material testing.

Titanium-Carbide Alloys

AMERICAN CUTTING ALLOYS, INC., 347 Madison Ave., New York City. Catalogue containing data on Cutanit, a titanium-carbide hard metal for machining steel and all other materials. The advantages and characteristics of this alloy are pointed out and examples of work performed by the use of this material in ordinary shop practice are given. In addition to general information concerning the use of Cutanit, including proper speeds and feeds, grinding, etc., dimensions of the various styles of tools are given.

Alloy Steels

WHEELOCK, LOVEJOY & CO., INC., 128 Sidney St., Cambridge, Mass. Loose-leaf booklet containing ten data sheets on Hy-Ten, Economo, and SAE alloy steels. The data sheets give heat-treating instructions, physical properties, and common uses of a wide range of special and alloy steels with carbon contents varying from 0.15 to 1.00 per cent. These sheets contain valuable information for purchasing agents and engineers concerned with the specification of materials for machine tool parts.

Hollow Set-Screws

ALLEN MFG. CO., Hartford, Conn. Circular outlining the special features of Allen chrome-molvbdenum hollow set-screws and socket-head cap-screws. Bulletin giving engineering data covering Allen hollow set-screws and socket-head cap-screws, including holding power and recommended sizes of set-screws and recommended tightening force of cap-screws. Folder entitled "The Biggest Little Thing in Industry," containing dimensions and price lists of these screws.

Bakelite Products

BAKELITE CORPORATION, River Road, Bound Brook, N. J. Booklet containing 48 pages of information covering Bakelite molding materials and their uses. A brief description of the molding process and the required equipment is included. The booklet is profusely illustrated with halftones showing the wide field of application of these materials, including the latest developments. It will suggest many new applications of plastic materials to users and prospective users.

Furnace Insulation

JOHNS-MANVILLE, 22 E. 40th St., New York City. Catalogue containing 72 pages descriptive of insulation methods that have proved effective in improving performance and reducing operating costs on all types of industrial furnaces and ovens. The requirements for each particular type of heating equipment are analyzed, and detailed recommendations are made. An appendix treats of J-M refractory cements and packings.

Olympic Bronze

CHASE BRASS & COPPER CO., INC., Waterbury, Conn. Booklet on Chase Olympic bronze, a high copper alloy containing silicon and zinc, designed especially for structural and engineering purposes. The booklet describes the fabrication and the tensile, mechanical, electrical and chemical properties of this alloy. It also gives the range of forms, sizes, weights, tempers, etc., in which this material is available.

V-Belt Drives

T. B. WOOD'S SONS CO., Chambersburg, Pa. Catalogue 176, containing price lists of Wood's standard V-belt cast-iron sheaves and V-belts. The prices of stock sheaves are printed in red for convenient reference. Prices are also given for V-flat pulleys and pressed-steel sheaves. Other information given includes data required to order a V-belt drive, as well as overload requirements and horsepower transmitted.

Electric Equipment

LOUIS ALLIS CO., Milwaukee, Wis. Bulletin 505-C, illustrating in detail the construction of Louis Allis polyphase squirrel-cage motors and listing the characteristics and uses of a dozen different types. Bulletin 502-B, illustrating and describing Louis Allis inverted rotary converters. Bulletin 509-A, describing the construction, operation, and uses of various types of frequency converters.

Precision Measuring Tools

VAN KEUREN CO., 12 Copeland St., Watertown, Boston, Mass. Catalogue 29, covering the line of precision measuring tools made by this company, which includes light-wave equipment for making flatness, length, and diameter measurements; gage blocks; microgages; plug gages; measuring wires; laps and surface plates; light-wave deflection bars; and special gages.

Lathes

SOUTH BEND LATHE WORKS, South Bend, Ind. Catalogue 94, illustrating the line of 1934 model South Bend back-geared screw-cutting lathes, ranging from 9 to 18 inches swing. Complete details, including prices, are given for ninety-six different sizes and styles. In addition, a large line of attachments, tools, and fixtures for regular and special machine work is illustrated.

Die Sets

F. C. DANNEMAN CO., 203 Lafayette St., New York City. Catalogue 34, containing engineering data for the tool and die designer. The data covers four types of dies, namely, reverse dies, regular dies, square dies, and round dies. The specifications listed make it an easy matter for one to determine the correct size of die set required without the use of templets.

Insulating Material

CONTINENTAL-DIAMOND FIBRE CO., Newark, Del. Catalogue descriptive of Micabond, a bonded mica insulating material. The various uses of this material are outlined, and properties, sizes, and specifications are given for the different forms in which this material is produced, including plates, paper, cloth, tape, tubing, rings, segments, and special parts.

Electric Equipment

GENERAL ELECTRIC CO., 10 Canal St., Schenectady, N. Y. Catalogue outlining the features of the GE gear-motors. Besides illustrating the different types, the booklet shows typical applications in various lines of industry. Bulletin GEA-704D, illustrating and describing indoor oil circuit breakers recommended for use on moderate capacity systems.

Elastic Stop-Nuts

A. G. A. Co., Elizabeth, N. J. Catalogue containing technical data on the use of elastic stop-nuts in the aeronautic, electrical, pneumatic tool, automotive, and radio industries. The data presented covers the use of elastic stop-nuts under actual field conditions and as a standard part of the equipment. Price lists are included for the various sizes.

Tapping Machines

R. G. HASKINS CO., 4634 W. Fulton St., Chicago, Ill. Circular illustrating and describing the special features of Haskins high-speed motor-driven tapping machines, which have a capacity for tapping at speeds up to 3000 revolutions per minute. Production figures are given for sixty-five different parts that have been tapped with this equipment.

Ball- and Roller-Bearing Pillow-Blocks

NORMA-HOFFMANN BEARINGS CORPORATION, Stamford, Conn. Bulletin 934-A, containing complete specifications covering various types of pillow-blocks equipped with self-aligning precision bearings of either ball or roller type. Load ratings and mounting instructions supplement the specification data.

Centrifugal Machines

SHARPLES SPECIALTY CO., 23rd and Westmoreland Sts., Philadelphia, Pa. Circular illustrating a number of different types of centrifugal machines for separating solids from liquids, recovering liquids from emulsions, recovering waste products, regenerating lubricating and other oils, acid-treating of oils, etc.

Carboloy Tools

CARBOLOY CO., INC., 2487 E. Grand Blvd., Detroit, Mich. Booklet entitled "Carboloy Cost-Saving Tools," illustrating this company's facilities for making these tools and showing representative types of Carboloy tools. The catalogue also contains a summary of the savings effected by these tools, as reported by users.

Rotary Pumps

ROOTS-CONNERSVILLE BLOWER CORPORATION, Connersville, Ind. Bulletin 60-B10, descriptive of Cycloidal rotary pumps, which are built for heavy-duty service, including the handling of viscous liquids, or for producing vacuums up to 26 inch HG, handling air and liquids simultaneously.

Air Compressors

INGERSOLL-RAND CO., 11 Broadway, New York City. Catalogue illustrating and describing Ingersoll-Rand Type XVG gas-engine-driven air and gas compressors, which are built in four sizes, of 60, 125, 190 and 260 horsepower, with two, four six, and eight power cylinders, respectively.

Pumps

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletin W-318-S3B, illustrating and describing Worthington Type UB two-stage volute centrifugal pumps. Circular D-475-S4A, outlining the features and uses of Worthington internal bronze-bearing type rotary pumps.

Tumbling, Washing, and Burnishing Machines

N. RANSOHOFF, INC., West 71st St., at Milcreek, Carthage, Cincinnati, Ohio. Catalogue covering the "Ideal" line of industrial machinery, including machines for tumbling, separating, cleaning, washing, burnishing, plating, and pickling metal parts.

Electric Equipment and Accessories

ESTERLINE-ANGUS CO., Indianapolis, Ind. Leaflet illustrating electric counters, cable clamps for connecting the potential circuits of instruments to insulated cables, meter carrying and shipping cases, portable current transformers, etc.

Motorpumps

INGERSOLL-RAND CO., 11 Broadway, New York City. Catalogue 7464, descriptive of the Cameron line of Motorpumps, which are built in twenty-six sizes, ranging from 1/4 to 30 horsepower. The catalogue illustrates the entire line and gives tables of capacities and performance data.

Belting

ALEXANDER BROS., INC., Philadelphia, Pa. Leaflet descriptive of a new general utility belt known as the Monobelt, which is intended for all regular drives. The leaflet outlines the special features of this belt and its advantages in regular power transmission service.

Dial and Limit Gages

STANDARD GAGE CO., INC., Poughkeepsie, N. Y. Catalogue 6A, covering the line of standard dial indicators and limit gages made by this concern. The various types and sizes are illustrated and complete specifications are given, including list prices.

Internal Race Grinders

LANDIS TOOL CO., Waynesboro, Pa. Catalogue G33, containing a detailed description, together with illustrations and specifications, of the new Landis 3 1/2-inch hydraulic internal race grinder provided with an automatic air sizing device.

Material-Handling Equipment

MATHEWS CONVEYOR CO., Ellwood City, Pa. Circular illustrating typical examples of the line of Mathews conveyors and conveying systems and their application to different classes of material-handling problems in industrial plants.

Electric Flow Meters

BROWN INSTRUMENT CO., Philadelphia, Pa. Folder describing the Brown electric flow meter.

Heat-Treating Equipment

W. S. ROCKWELL CO., 50 Church St., New York City. Circular 346, outlining the advantages of Rockwell portable, gas fuel, heat-treating and carburizing furnaces. A table of standard sizes and operating data is included.

Material-Handling Equipment

CHAIN BELT CO., Milwaukee, Wis. Circular entitled "Bulk Handling by Belt," illustrating Rex Stearns Timken idlers for conveying equipment, and typical applications in various industries handling bulk materials.

Hardening Equipment

LEEDS & NORTHRUP CO., 4901 Stenton Ave., Philadelphia, Pa. Circular outlining the advantages of the triple control Hump method of hardening.

High-Manganese Steels

UNION DRAWN STEEL CO., Massillon, Ohio. Circular outlining the characteristics of Union "Hymo" high-manganese steels. Charts showing physical properties and heat-treatment are included.

Gears and Speed Reducers

D. O. JAMES MFG. CO., 1120 W. Monroe St., Chicago, Ill. Leaflets illustrating and describing the company's speed reducers and herringbone gears.

Optical Instruments

BAUSCH & LOMB OPTICAL CO., Rochester, N. Y. Folder descriptive of the new Fitz micro-manipulator for the efficient manipulation of small objects or cells in the field of the microscope during observation.

COMING EVENTS

JUNE 17-22—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS to be held at Saranac Inn, Lake Saranac, N. Y. John A. C. Warner, general manager, 29 W. 39th St., New York City.

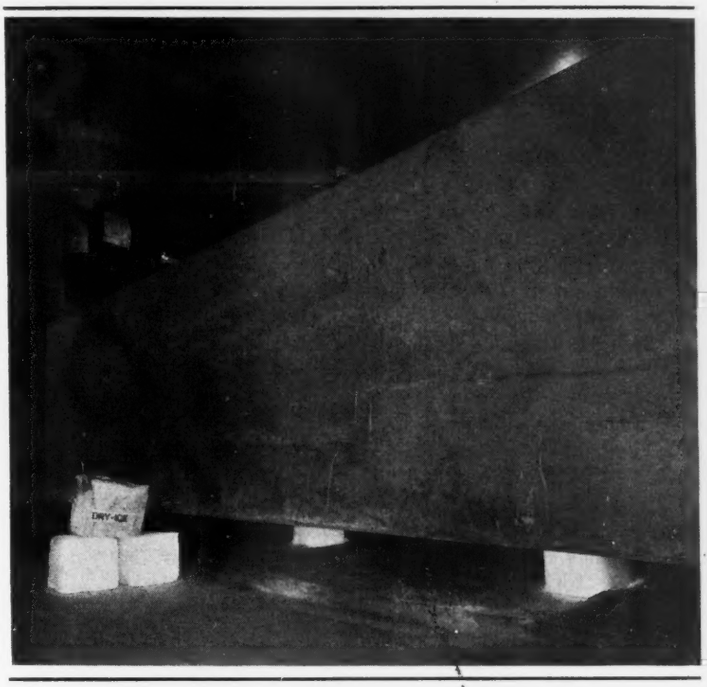
JUNE 25-28—Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at Denver, Colo., with headquarters at the Cosmopolitan Hotel. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

JUNE 25-29—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at Chalfonte-Haddon Hall, Atlantic City, N. J. C. L. Warwick, secretary-treasurer, 260 S. Broad St., Philadelphia.

JULY 3-9—FOURTH INTERNATIONAL CONGRESS FOR APPLIED MECHANICS to be held at Cambridge, England. For detailed information, address Applied Mechanics Division, American Society of Mechanical Engineers, 29 W. 39th St., New York.

OCTOBER 1-5—NATIONAL METAL CONGRESS AND EXPOSITION, Commerce Hall, Port of Authority Bldg., New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, director.

OCTOBER 1-5—Annual convention of the AMERICAN SOCIETY FOR METALS (formerly the American Society for Steel Treating), New York City. W. H. Eisenman, 7016 Euclid Ave., Cleveland, Ohio, secretary.



Dry Ice Aids in Locating a Cumbersome Tank. The Tank Weighed 6500 Pounds and Was 20 Feet Long by 13 Feet Wide by 5 Feet High. It Had to be Carefully Located in a Cramped Space. The Tank was Moved Approximately into Place and then Lowered by Jacks until it Rested on Six Blocks of Dry Ice. One Man Could then Push the Tank Lengthwise and Sidewise with Ease into the Correct Location. Blocking was Provided to Keep the Tank from Shifting, and as the Dry Ice Evaporated, the Tank Gradually Settled into Place.

Industry Reports Business Improvement

The domestic business in the machine tool industry continues its upward trend in an encouraging manner. The orders booked for both domestic and foreign shipments in January, this year, were over three times the figure for January a year ago. There has, however, been a falling off in foreign orders from the last months of 1933, when some very large foreign orders were booked.

The Warner & Swasey Co., Cleveland, Ohio, builder of turret lathes, states that the 1932 output of the company was doubled in 1933 and that there is every indication that the 1933 output will be equalled in the first half of 1934. In the oil states, especially eastern Texas, the contrast between the conditions this year and last is startling. Business is active and optimistic. "Orders for oil-field equipment," says C. S. Stilwell, sales manager of the Warner & Swasey Co., "have so increased that some manufacturers of oil-field tools are running two and three shifts."

Automobile production is going forward at a very satisfactory pace. When complete figures for March are available, it is expected that Ford's production will exceed 80,000 cars and trucks, and that Chevrolet will attain a somewhat similar figure. The March production of Plymouth cars will probably exceed 40,000, and the production of other well-known makes will increase in similar proportions. The total February production almost reached the quarter-million mark, and was the largest February production in four years.

The National Automobile Chamber of Commerce reports that in the member factories there are 183,000 workers on the job at hourly rates equal to those paid in the peak year of 1929. Employment in February in the automotive industry surpassed all records since September, 1929. W. J. Cronin, secretary of the Manufacturers' Committee of the Chamber, stated before the employment group of the National Recovery Administration that "despite the fact that labor costs are 18 per cent greater than in 1926, the public is getting a far better car at 10 per cent lower price."

The automobile companies that belong to the National Automobile Chamber of Commerce produced over 170,000 vehicles in February, as compared with 93,400 in February a year ago, and 101,600 in January this year.

The Ohmer Register Co. of Dayton, Ohio, announces that the first two months of the year showed an increase of 180 per cent in cash register sales over the same period last year. The repeal of prohibition is said to have given a decided impetus to cash register sales to hotels, restaurants, and retail stores.

An increase of two and one-half times in the February orders for cemented-carbide tools and dies is reported by the Carboloy Co., Inc., Detroit, Mich., as compared with February, 1933. In comparison with the monthly average for the entire year of 1933, the February, 1934, sales represent an increase of considerably more than double.

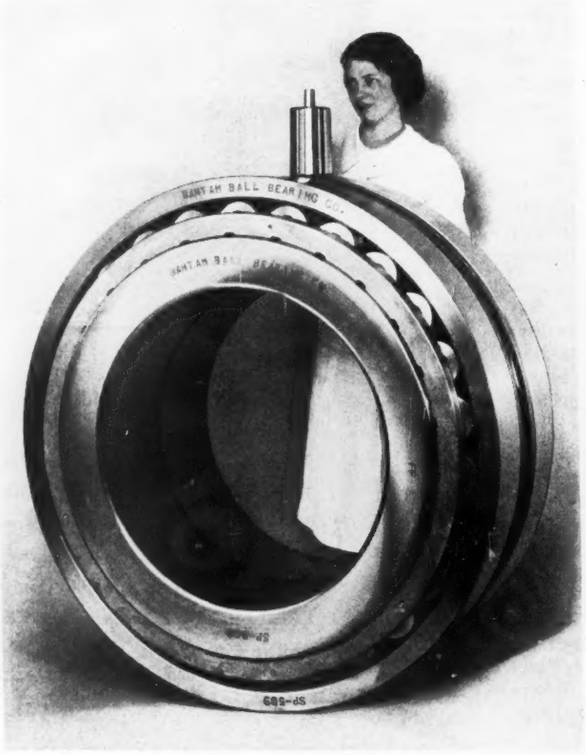
Enthusiastic over the promise of exceptional sales volume during the coming year, the Frigidaire Corporation has announced the introduction of the most comprehensive line of household electric refrigerators in its history, listing fifteen models ranging in price from $100 to $500.

The largest award in the electrical crane industry during the last five years has just been given to the Harnischfeger Corporation, Milwaukee, Wis., for equipment to be used on the Boulder Dam project. The total amount of the contract is approximately $250,000, and involves the construction of four 300-ton cranes and one 50-ton crane. Two of the 300-ton cranes will be installed in the power house for handling the huge generators.

* * *

Proper Lubrication Saves the Day

A contractor in Iowa encountered bearing difficulties with two of his road-working machines. Upon investigation, it was found that the bearings were running at a temperature of 160 degrees F. when the machines were operated at only intermediate speeds and partial load. It was suggested that Oildag be tried as a lubricant. The result of using this lubricant was that, after operating three miles at full speed and load, the bearing temperature dropped to 148 degrees F. During the next two miles it dropped to 142 degrees F., and after two more miles to 128 degrees F. Under normal operation the following day, the temperature reached only 118 degrees F., although the atmospheric temperature both days was 96 degrees in the sun.



Six Million Pounds of Antifriction Support is Afforded by This Huge Taper Roller Bearing. It was Made by the Bantam Ball Bearing Co., South Bend, Ind., for the World's Largest Four-high, Cold-reduction Steel Mill. This Bearing Measures 51 Inches Outside Diameter by 25 1/2 Inches in Length. The Rollers are 4 1/2 Inches Mean Diameter by 7 Inches Long. Two-row Inverted-angle Roller Bearings of This Type were Provided for the Backing Roll Necks of the Mill, and Four-row Bearings for the Necks of the Working Rolls. The 1500-horsepower Gear Drive for This Mill is Completely Equipped with Taper Roller Bearings Made by the Same Concern.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts and Material-Handling Appliances Recently Placed on the Market

Landis 3½-Inch Hydraulic Internal Race Grinder

An automatic air sizing device is the main feature of a hydraulically operated grinding machine recently developed by the Landis Tool Co., Waynesboro, Pa., for finishing the internal races of ball bearings. The nominal size of the machine is 3 1/2 inches, but races up to 3 3/4 inches pitch diameter can be accommodated. Not only single-row races, but double-row races and thrust races as well, can be finished. When the water guard and sizing device are removed, the machine has a maximum swing of 10 inches.

With the standard set-up, the machine operates automatically, except for loading and unloading. The operator places a race in the chuck and feeds the grinding wheel into the work. As soon as the wheel reaches the grinding position, the work starts rotating, the work-head starts oscillating, and the wheel is automatically fed at a fast rate into grinding contact with the race. The hydraulic feed mechanism then comes into play and feeds the wheel at the predetermined roughing rate.

When the work is rough-ground to within about 0.001 inch of the finish size, the amount being adjustable, the feed is automatically reduced to a very fine finishing rate. If desired, the coolant can be automatically cut off at this point for a dry finishing operation. As soon as the race reaches the finish size, the wheel automatically backs away enough so that it can be removed from the race, and the oscillation stops. The operator then withdraws the wheel from the race, removes the sizing device, and reloads.

The oscillating head is mounted on two heavily preloaded ball bearings. It is oscillated by a hydraulic vane type motor of a balanced design, which is cushioned at reversal points so that the oscillation is smooth even at highest speeds. The operator can readily set the head to move the same amount either side of center or any desired amount for non-symmetrical races. For grinding thrust races, the hydraulic motor and head assembly is turned 90 degrees, and the head is oscillated in this position.

The work-head is driven by a 3/4-horsepower vertical motor at the left-hand end of the bed. The work-head spindle is the only rotating shaft that is not mounted in ball bearings, this spindle being mounted in bronze bearings which can be accurately adjusted to compensate for wear. The work-head is mounted on two dovetail slides located at right angles to each other. The lower slide is adjusted to bring the work-center the correct distance from the oscillating center for generating the correct race curvature. The upper slide is moved parallel to the work axis for centering the groove in the ring. For grinding double-row races, a lever is provided, by means of which the slide can be moved rapidly between two adjustable stops. Thus both races can be ground at the same setting, accurately spaced and centered.

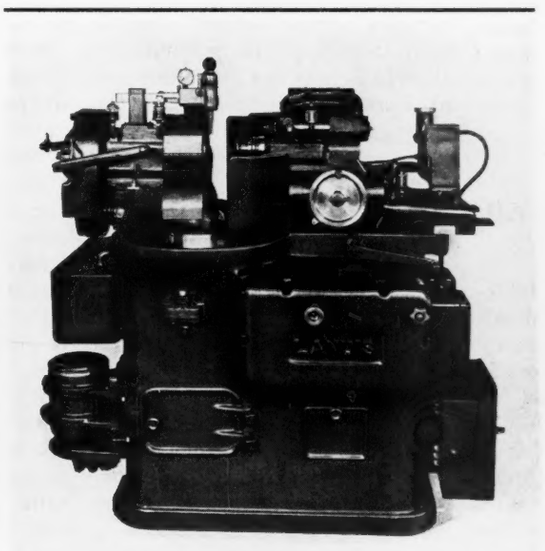


Fig. 1. Landis Hydraulic Internal Race Grinder with Air Sizing Device

The air sizing device is based on the principle that if air is escaping from a pressure line, the pressure in this line is affected by the size and shape of the outlet through which it is escaping. This principle was described in detail in an article published in MACHINERY, November, 1933, page 170. On the internal race grinder, a diamond-tipped finger rides lightly on the raceway during the

entire grinding operation. This finger has an up-and-down movement under spring tension. An extension at the top of the finger forms an air gap between it and the air outlet which is attached to the stationary portion of the sizing head. As the finger moves upward during grinding, the size of the air gap changes. Simultaneously with this upward movement, mercury in a U-tube located in a control box at the right-hand end of the machine rises and closes electrical circuits at the proper time in the grinding cycle. These circuits, in turn, control the feeding movement of the grinding wheel.

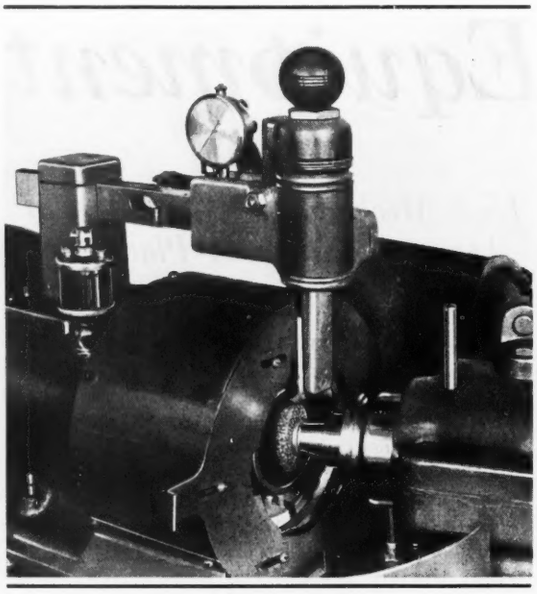


Fig. 2. Close-up View of the Sizing Device in the Operating Position

Once set, the sizing device requires no attention unless the size of the race being ground is changed. A dial gage at the top of the sizing device visually indicates the progress of the grinding cycle. The three feeding movements imparted automatically to the grinding wheel as outlined, are actuated hydraulically.

An Ex-Cell-O wheel-spindle is supplied. It operates at speeds of 12,500, 15,000, and 18,000 revolutions per minute. The weight of this machine without the electric motors is 3080 pounds.

Monobelt—a Belt for All Regular Drives

Flat belting made of vegetable-tanned leather having high adhesive properties and thoroughly stretched by a special process is being placed on the market by Alexander Bros., Inc., 406 N. Third St., Philadelphia, Pa. It is claimed that the stretch is accurately regulated in each piece of leather. In single-ply belts, leather with minimum stretch is used. In double-ply belts, the pulley side of the belt is made of the same leather as is used for single-ply belts, but the outer ply is made of leather having more elastic stretch. With this construction, the inner ply makes a full close contact on the pulley surface and the internal stress is said to be evenly distributed over the belt.

This belt is made in one standard thickness for each width. The thickness is increased with the width, on the principle that narrow belts are generally used on small-diameter pulleys where a thin belt is usually proper, whereas wider belts are used on larger pulleys where a heavier belt is suitable.

This new belt has been called "Monobelt," because it is suitable for practically all drives consisting of two pulleys, one driving and the other driven. It is especially suitable for high-speed drives, in which pulleys of small diameter are used. However, this type of belt should not be employed under conditions where the belt is subjected to a reverse flexing, as with idler-pulley or serpentine drives.

Lees-Bradner Helical-Gear Lead-Testing Machine

The only positive method of measuring helical gears is one in which a point of contact with the gear tooth is moved relative thereto across the gear face and at a uniform distance from the gear axis while imparting to the gear an angular or rotative motion equal to exactly one complete revolution during the time that the contact point moves through the exact distance of the lead. The lead of a gear is a constant quantity, no matter where measurements may be taken on the tooth; hence when the lead is found to be correct, the helix angles must also be correct. A machine recently developed by the Lees-Bradner Co., Cleveland, Ohio, uses this method of checking the helix angles or the lead of helical gears. An additional feature of this machine is that it has provision for accurately calibrating its settings.

The gear being tested is mounted between centers in the machine, as illustrated. An adjustable tooth contactor connected to a direct-reading indicator is mounted on the carriage at the front of the machine. This carriage also has an angularly adjustable straightedge and is traversed on the bed parallel to the headstock and tailstock centers. The headstock is provided with a spindle mounted in self-adjusting precision ball bearings. This spindle carries an accurately ground and calibrated involute cam.

The headstock is constructed with a transverse cross-slide, on one end of which is mounted an adjustable roller which maintains contact with the involute cam on the spindle. The other end of this cross-slide is provided with adjustable shoes or contact members which engage the straightedge of the carriage. The angular adjustment of this

straightedge is set according to the lead of the gear being tested.

In operation, the tooth contactor is engaged with one of the gear teeth. The indicator carriage is traversed parallel to the gear axis by means of the handwheel at the front of the machine. As the carriage moves, the transverse cross-slide of the headstock is moved at right angles to the work-spindle. This movement causes the roller on the cross-slide, by engagement with the involute cam, to rotate the spindle and the gear being tested. Thus it will be seen that a simple straight-line motion of the indicator is converted into rotary motion of the spindle and gear by a few accurately made parts.

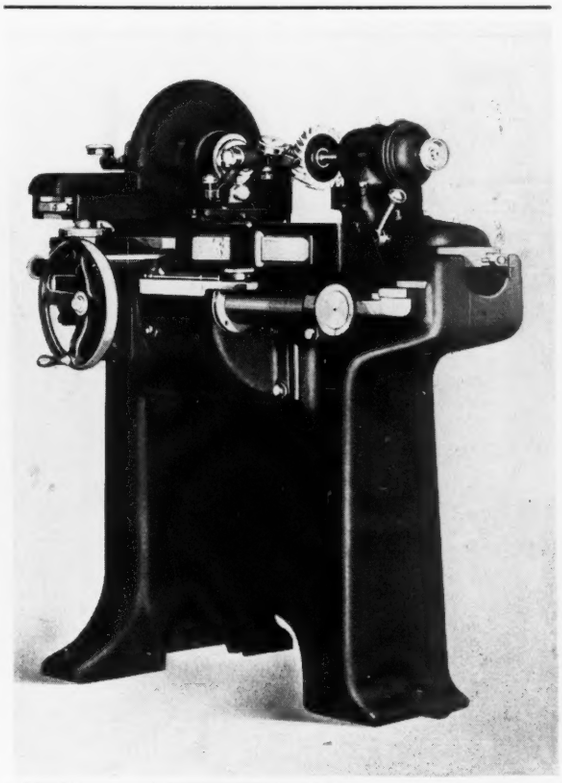
Any deviation from the true lead of the gear is registered directly on the indicator to 0.0001 inch. To insure that the indicator reading of the gear tooth is a true representation of the deviation from the theoretical, provision has been made in the machine for an accurate calibration of the rotary motion of the work-spindle relative to a known distance traversed by the contactor in engagement with the gear tooth. It is not considered sufficient, with the delicate measurements being made, to assume that the angular adjustment of the straightedge, accurately as it may be set, will insure correct and accurate readings.

The rear of the work-spindle has been provided with an accurately ground index-plate which is engaged by an indicator reading direct to 0.0001 inch. On the front of the bed, there is a V-block with an adjustable stop that may be located in a number of positions in the V-block. The front of the indicator carriage is equipped with an adjustable holder, on which is mounted another 0.0001-inch indicator.

After the straightedge on the indicator carriage has been adjusted according to the lead of the gear being tested, the indicator for the index-plate on the work-spindle is engaged with one of the notches in the index-plate and the indicator dial is set to zero. A set of precision gage-blocks is then placed in position in the V-block at the front of the machine, with one end positioned against the stop. The indicator at the front of the carriage is next adjusted against the other end of the gage-blocks and the dial is set to zero. The indicator that engages the index-plate is then swung out of position and the gage-blocks are removed from the machine.

The work-spindle and the index-plate are now rotated through an angular distance of one or more divisions, this movement being checked by swinging the index-plate indicator back into position. The distance traversed by the indicator carriage and the tooth contactor is now checked by reinserting the gage-blocks as before.

Since the index-plate is provided with twenty divisions, the linear movement of the tooth contactor can be checked, if thought desirable, for each twentieth of the lead. In this way, the machine can be accurately calibrated before a gear is tested.



Lees-Bradner Helical Gear Testing Machine with Provision for Calibrating its Settings

Wearweld—a Hard-Surfacing Electrode

A shielded-arc electrode intended for building up steel surfaces to resist shock and abrasion is being placed on the market under the trade name of "Wearweld," by the Lincoln Electric Co., Cleveland, Ohio. The deposits made with this electrode consist of an air-hardening alloy steel which is said to possess an unusual combination of hardness and toughness. This electrode can be used to build up all steels except those of the austenitic type. It is particularly suitable for facing parts subjected to rolling or sliding abrasion, battering, sand abrasion, and repeated impact.

A single layer made with this electrode on mild steel has a hardness of from 40 to 45 on the Rockwell C scale, while additional layers have a hardness of from 48 to 52. On 0.70 per cent carbon steel, a single layer has a hardness of 50 to 55.

This electrode is manufactured in 1/4 and 3/16 inch diameters. It comes in 18-inch lengths. The heavy coating on the electrode allows the transfer of molten metal to take place under non-oxidizing conditions.

Reed-Prentice Vertical Milling and Die-Sinking Machine

The No. 3V vertical milling and die-sinking machine recently developed by the Reed-Prentice Corporation, Worcester, Mass., is driven from a vertical ball-bearing motor of the flange-mounted type. The motor is mounted on a bracket fitted to horizontal ways at the top of the column. Power is transmitted to the cutter-spindle through an endless V-belt and four-step pulleys that provide ten spindle speeds. By turning a handwheel, the motor bracket can be adjusted back and forth on the column to obtain proper tension of the driving belt and to facilitate changing the belt from one pulley step to another.

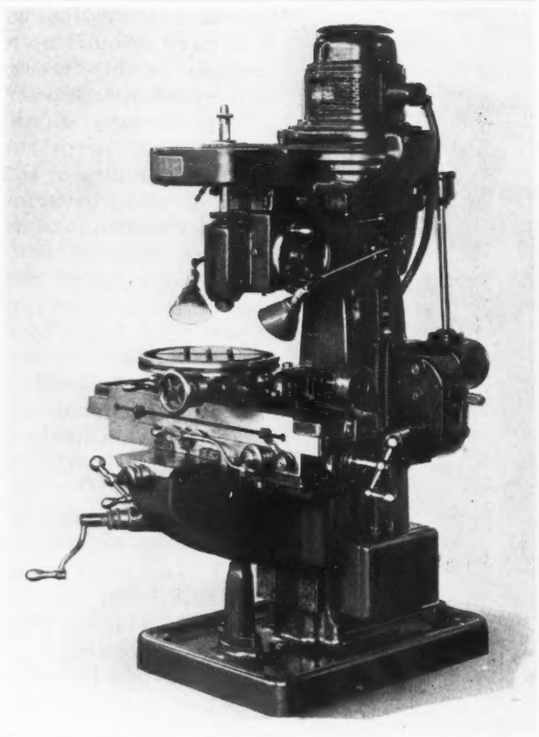
With a motor running at 1800 revolutions per minute, spindle speeds from 600 to 4000 revolutions per minute are available. With a motor running at 1200 revolutions per minute, spindle speeds ranging from 395 to 2630 revolutions per minute may be obtained. When slower speeds are required, a motor having a speed of 900 revolutions per minute can be furnished. The motor and spindle pulleys are balanced to suit operation at high speed. They are made of heat-treated aluminum alloy. A reversing type of magnetic switch provides for quick stopping of the spindle.

Power for the feed is taken direct from the motor shaft by helical gears and transmitted through a vertical shaft to a gear-box. Six feeds are available for each spindle speed. They range from 0.0004 to 0.047 inch per spindle revolution. With a motor running at 1800 revolutions per minute, the feed per minute ranges from 1.75 to 28 inches, and with a motor having a speed of 1200 revolutions per minute, the feed per minute ranges from 1.15 to 18 1/2 inches.

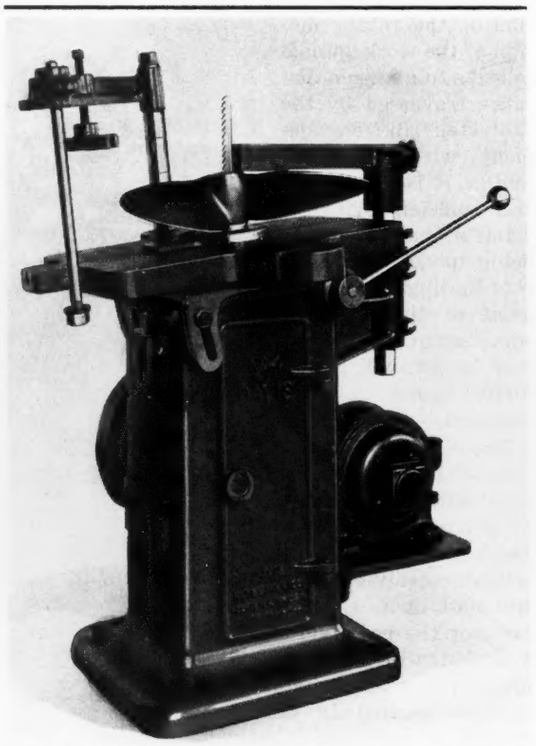
The important specifications of this machine are identical with those of the standard No. 3 machine. They are: Length of longitudinal power feed, 21 inches; length of cross-feed, 12 inches; vertical feed of knee, 17 inches; travel of head, 3 1/2 inches; maximum distance from spindle to top of rotary table, 12 inches; maximum distance from spindle to top of longitudinal table, 16 1/2 inches; and maximum distance from center of spindle to frame, 16 inches.

Davis Keyseater with Tilting Table

The table of a keyseating machine recently designed by the Davis Keyseater Co., 405 Exchange St., Rochester, N. Y., can be tilted to any angle required for cutting keyways in bores tapered to a maximum of 3 inches in one foot. The cutter remains vertical



Reed-Prentice Die-sinking Machine Equipped with a Vertical Ball-bearing Motor



Davis Keyseater with Table that can be Tilted for Cutting Keyways in Tapered Bores

in all stages of the operation, a feature that facilitates setting up the work. A scale shows the taper per foot for which the table is set at any time. The tilting of the table is conveniently accomplished by turning a screw.

Both straight and tapered keyways can be produced in all kinds of bores. The cutter is made with a series of teeth similar to a saw or broach. Several of the teeth cut at one time, and hence it is impossible for the cutter to dig into the work. The cutter is reciprocated by the cross-head to which it is attached. An adjustment is supplied for locating the cutter centrally in the work. During successive strokes of the cutter, the table is fed by means of the hand-lever at the front of the machine until the keyway has been cut to the desired depth. An adjustable stop is provided to prevent further movement of the table when the proper depth has been reached. The hand-lever actuates a pinion which engages a rack fastened to the table.

This machine is built in three sizes which cut keyways from 1/16 to 1/2 inch; 1/16 to 1 inch; and 1/16 to 1 1/2 inches. Cutters 16 or 20 inches long can be regularly supplied for taking cuts from 3 1/2 to 8 inches in length. The maximum diameter of work accommodated by the regular machines is 16, 24, and 30 inches, while the maximum heights are 4 1/2, 8, and 14 inches. Either a tight and loose pulley drive or a direct-connected motor drive can be furnished.

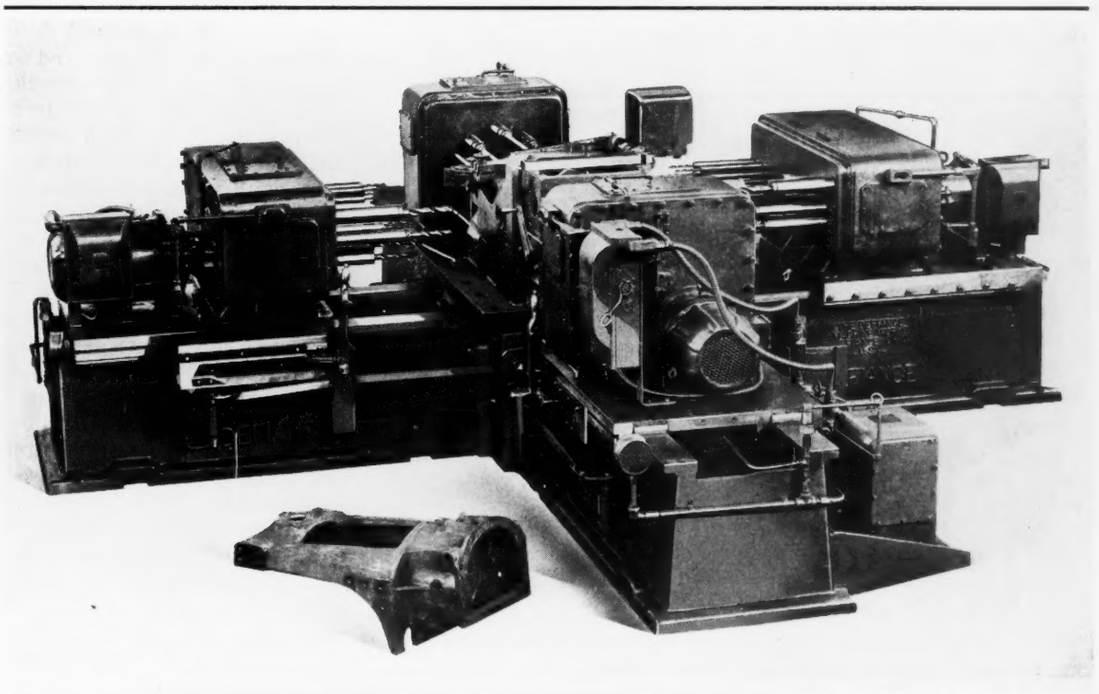
Defiance Four-Way Horizontal Drilling and Reaming Machine

A four-way horizontal type of machine of extra heavy construction was recently built by the Defiance Machine Works, Defiance, Ohio, for drilling and reaming fifty-three holes in main-front tractor frames. The base is made with a central member that holds the work fixture. Four separate beds attached to the central member carry slides on which multiple-spindle heads and their direct-connected motors are mounted.

The multiple-spindle heads are thoroughly enclosed and lubricated by a force-feed system. Any number of heads and spindles can be provided. All spindles in the drill heads can be equipped with either bronze or anti-friction bearings; however, in the case of anti-friction bearings, there must be sufficient distance between centers.

The box type work fixture is removable. It is equipped with guide bushings for the drills and reamers. Quick-acting screw clamps hold the tractor frame.

Two Oilgear pumps are provided for feeding the heads, each pump driving two opposed heads. Either two or all four heads can be made to operate at the same time. The Oilgear pumps are each driven by a 3-horsepower motor running at 900 revolutions per minute, while the heads are driven by 7 1/2- and 15-horsepower motors. The production of this machine is from ten to twelve tractor frames an hour. The net weight is 35,000 pounds.



Defiance Four-way Drilling and Reaming Machine of Extra Heavy Construction

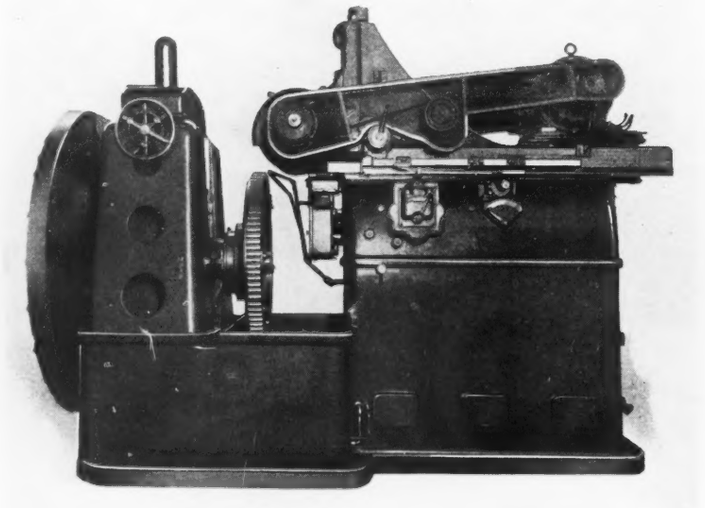
Large Gear-Tooth Grinding Machine

Spur gears from 24 to 72 inches outside diameter and up to 12 inches face width can be handled by the large gear-tooth grinding machine here illustrated, which was built by the Gear Grinding Machine Co., Conant Road and Grand Trunk Railway, Detroit, Mich. The teeth may be from 4 to 3/4 diametral pitch and of any pressure angle.

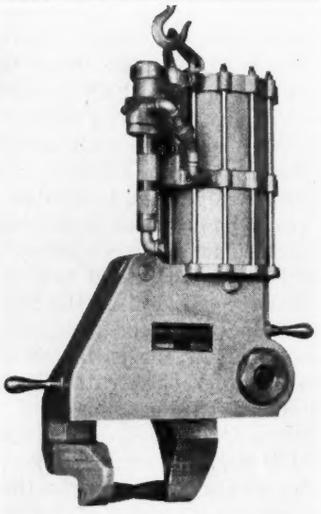
Hydraulic power actuates the wheel carriage and the indexing mechanism. In addition, the heavy wheel-head and the work-head are counterbalanced hydraulically. The operation of the machine is based on the same principle as the smaller machines built by the company, use being made of a grinding wheel that is dressed to the shape and size of the space between two teeth of the gear that is to be ground. The wheel grinds the adjacent sides of two teeth and the bottom of the space between them as it reciprocates across the gear at each indexing of the work-head. The gear remains stationary during the grinding.

Indexing of the work is controlled by an unusually accurate worm-wheel, which was made 90 inches in diameter in order to minimize errors in the work. It is claimed that even with a gear 72 inches in diameter, the accumulative error in grinding all the teeth of the gear will not be in excess of 0.0005 inch. When a cut has been taken on all the teeth of a gear, the wheel is trued or trimmed and the work-head is moved upward by means of a micrometer adjustment, so that the desired amount of stock will be removed during the next series of cuts around the gear. The cycle is repeated until the gear teeth have been finished.

Three diamonds are used to trim the grinding wheel accurately to the desired shape and dimensions. The movements of these diamonds are controlled by large templets. Power is delivered to the grinding wheel from a 30-horsepower motor by two flat belts, which are applied on opposite sides of the wheel so as to eliminate vibration. A 7 1/2-horsepower motor drives the hydraulic pump; a 1-horsepower motor drives the work-spindle, in setting up a gear; and a 1/4-horsepower motor drives the lubricating system. This machine weighs approximately 50,000 pounds.



Teeth of Gears up to 72 Inches Outside Diameter can be Ground in This Machine



Hanna Alligator Type 20-ton Squeeze Riveter

Hanna Alligator Type Squeeze Riveter

A light pneumatic squeeze riveter of the alligator or nut-cracker type, recently developed by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill., is shown in the accompanying illustration. The mechanism of this equipment is entirely enclosed. A roller and toggle transmit the power movement of a cylinder-piston unit to the moving die in such a manner that the die is closed upon the rivet with minimum power consumption. A predetermined tonnage is exerted on the dies, even with a considerable variation in the length and diameter of the rivets.

The riveter shown develops a pressure of 20 tons between the dies, which is sufficient for heading 3/8-inch rivets cold and 5/8-inch rivets hot. The die stroke is 2 inches.

Both jaws of the riveter can be entered into a pocket, or pockets, for heading rivets that could not be reached by riveters of ordinary construction. The reach and shape of the jaws on this alligator-type riveting equipment can be varied considerably to suit a wide range of operating conditions.

Bantam Bearing with Both Straight and Taper Rollers

Combined Taper and Straight Roller Bearing

A large three-row combination type of bearing made by the Bantam Ball Bearing Co., 3400 W. Sample St., South Bend, Ind., for heavy machine applications is shown in the accompanying illustration. This bearing combines straight rollers and taper rollers for carrying both radial and thrust loads. The bearing is 26 inches inside diameter, 42 inches outside diameter, and 25 1/2 inches long.

One of the most important advantages claimed for this bearing is its inherent load-distributing characteristic. The manufacturer points out that roll-neck bearings for steel mills, and other bearings subjected to heavy offset loads, carry almost all the load on the row of rollers that is closest to the point of load application. A pair of three-row bearings of the design illustrated, inspected after 65,000 tons of steel had been rolled in a continuous strip mill, showed unusually good load distribution. The rollers farthest from the roll body indicated almost as heavy a contact as the rollers nearest to it.

The cages of the three-row bearings are one-piece rigid bronze castings. The roller pockets are shaped to facilitate lubrication of the rollers, and they are made with accurately machined roller aligning pads.

Westinghouse Electronic Timer

The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has developed a Type HA electronic timer which measures out a predetermined length of time and then closes or opens contacts. The initiating impulse is given through the medium of a push-button, foot-treadle, or cam-operated switch.

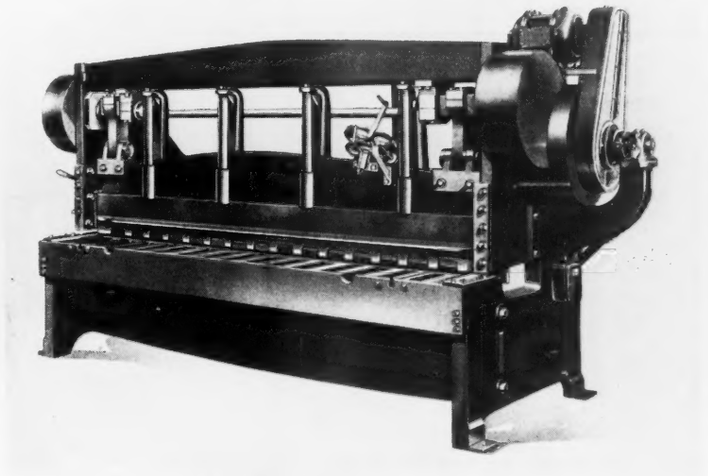
This device is intended for such uses as timing current flow in spot and projection welding operations, X-ray timing, and similar applications requiring an easily adjustable and accurately maintained time delay. The length of time measured is adjustable from 1/10 second to 45 seconds. This device can be applied to any spot or projection welding machine in service that is provided with a magnetic main contactor.

Chicago Power Shear with Front-Operated Back Gage

The most important feature of a Chicago steel power shear recently added to the line of the Dreis & Krump Mfg. Co., 74th St. and Loomis Blvd., Chicago, Ill., is a new type of back gage which is operated from the front of the machine. This feature speeds up shearing, because the operator does not need to walk around to the back of the machine each time that he wants to set the gage.

The operating crank of this gage may be seen in the illustration, as well as a dial that is graduated in inches and in sixty-fourths of an inch to show gage settings. The graduations are double scale, so that accurate readings can be made with ease. Both screws that actuate the back gage are operated in unison, thus keeping the gage in alignment with the knife. The gage is locked automatically in any setting. To permit taper cutting, the gage-adjusting screws can be disconnected.

Other new features of the machine include an upper blade with a low cutting angle, and a high-



Power Shear with Back Gage that is Operated from the Front of the Machine

pressure one-piece hold-down. The hold-down removes any buckles or unevenness in sheets before shearing, and thus adds to the accuracy of the cut. Individual hold-down fingers can be supplied. The shear is of all-steel plate construction.

Warner & Swasey Electric Turret Lathe

An alternating-current motor drive that is completely self-contained is the main feature of a turret lathe recently designed by the Warner & Swasey Co., Cleveland, Ohio. The rotor is mounted directly on the spindle, while the stator is assembled in the head housing. All gearing and belts are eliminated, thus giving a simple construction that is easily balanced because there is only one rotating unit.

This machine is designed for operation at the high cutting speeds that are becoming increasingly popular, especially when carbide or diamond cutting tools are employed. The turret lathe is particularly adapted for work of small diameter, made of non-ferrous materials. Four speeds are available in either direction —600, 1200, 1800, and 3600 revolutions per minute, respectively.

Overheating is guarded against by fan blades that are rigidly attached to the rotor. These blades circulate air at a high velocity through cored passages around the spindle bearings and the motor windings. Two levers which respond instantly to finger-tip pressure control the spindle electrically through a drum type controller and automatic relays. The short lever is used to select the four spindle speeds, while the long lever is manipulated to start, stop, and reverse the spindle. The spindle can be reversed quickly without any damage to the motor. A large band brake is actuated by the long lever when the lathe is in the neutral position, thus preventing rotation of the spindle while attaching chucks, loading work, etc.

The high speeds of this new turret lathe necessitated the development of a friction-finger bar feed, which prevents vibration by holding the bars concentrically in the spindle through the use of a removable filler tube. The bars are enclosed their full length for safety.

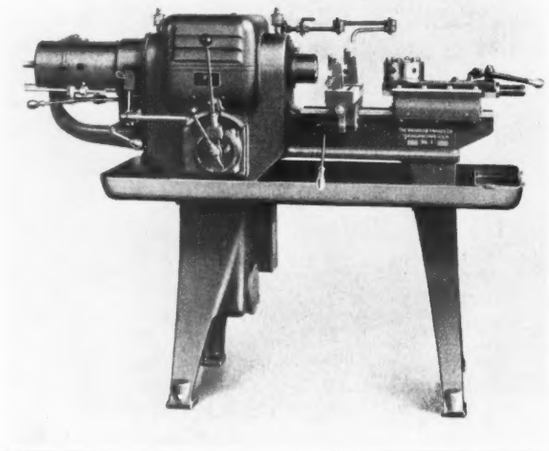
The friction feed-finger lies immediately behind the collet, so that bar stock can be used to the end. This finger is mounted on a feed-tube which is reciprocated by a fork, no cams being used. A simple hand-lever and toggle links feed the stock, close the collet, and return the feed-finger. The length of feed is controlled by a collar that is quickly set.

Acme Two-Wheel Polishing and Buffing Machine

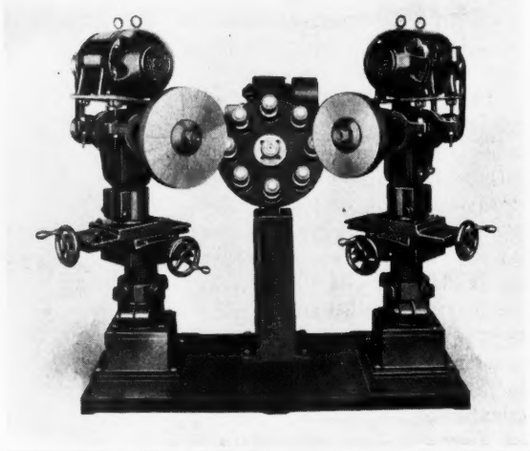
Two wheel units, an indexing head, and eight work-holders make up the automatic polishing and buffing machine here illustrated, which is one of several recently built by the Acme Mfg. Co., 1645 Howard St., Detroit, Mich. This machine is designed to perform two operations at one loading of the work. Both wheels may contact with the same surface of the work, as in cutting down and coloring, or one wheel may be arranged to contact with the side and the other with the face of the part.

The two wheel units, or lathes, are adjustable so that the contact of the wheels with the work can be made at any desired angle. Adjustments are also provided to compensate for wheel wear. V-belts drive the buffing spindles.

The eight-spindle work-head indexes automatically at rates of from 250 to 1200 times an hour, depending upon the length of time necessary to obtain the re-



Warner & Swasey Turret Lathe with Motor Built in the Head



Polishing and Buffing Machine that Performs Two Operations on a Part

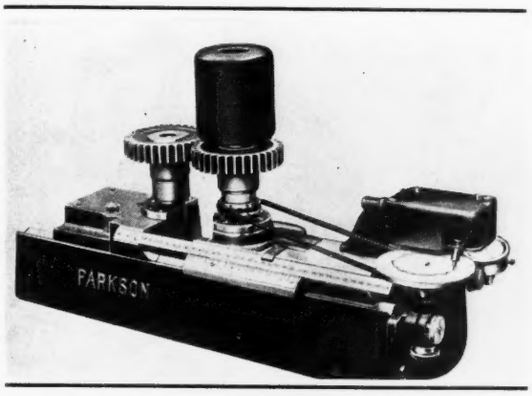


Fig. 1. Parkson Spur-gear Tester Equipped with Circular-chart Recording Device

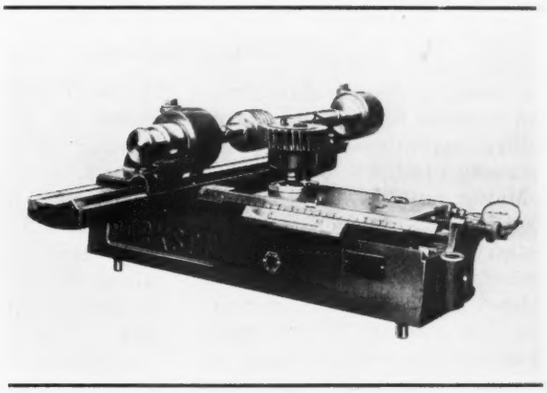


Fig. 2. Fixture for Testing Worm-gearing, Equipped with Dial Indicator

quired finish on the work. The spindles opposite the buffing wheels revolve, while the three lower spindles remain stationary for loading.

The work is automatically ejected during the indexing of the head, when the part reaches the point midway between the right-hand revolving station and the next lower station. Each piece is automatically gripped just before it is brought into contact with the left-hand buffing wheel. These features reduce the work of the operator to merely placing the parts on the chucks. Parts up to 4 1/2 inches in diameter can be handled. Machines of this type are used for polishing and buffing small stampings, die-castings, and similar parts.

Parkson Gear Testers

The Parkson line of fixtures for testing spur, bevel, helical, and worm gears is being introduced on the market by the George Scherr Co., 128 Lafayette St., New York City. Worms can also be tested with these fixtures. These gear testers are designed to show the combined errors of gears rather than to measure individual errors. A test will quickly determine whether or not a pair of gears will run silently and properly.

The testing fixture may be equipped either with a dial indicator, as shown in Fig. 2, to give a quick visible reading, or with a recording device, as illustrated in Fig. 1, which automatically produces a permanent record in red ink on a circular chart. A test usually consists of running the gear to be checked in engagement with a master gear, although pairs of gears can be inspected without a master.

Both gears are so mounted as to revolve freely on stationary arbors. One arbor is attached to a carriage that is clamped to the bed of the fixture for an inspection. The other arbor is mounted on a carriage that has a floating longitudinal movement on the bed. The latter carriage rolls on three balls. Its movements can be limited or stopped completely, and the center distance between the two arbors can be accurately adjusted by reference to a scale and vernier.

When the gears are rotated during an inspection, slight movements are imparted to the floating carriage by inaccuracies in the gear teeth. The extent of these movements, as shown by the dial indicator or the recording device, determines the accuracy of the gears. A spring plunger tends to hold the gear on the floating carriage at the correct center distance from its mating gear.

These gear testers are made in three different sizes. They are intended for inspecting finished gears and for keeping a check on machines during various stages of gear manufacture.

High-Speed Lowering Relay for Cranes

The lowering speed of hoist drives on cranes built by the Harnischfeger Corporation, Milwaukee, Wis., may be increased by using a high-speed lowering relay recently devised by the concern. This relay speeds up the lowering of loads without reducing the safety factor or minimizing the accuracy of the control. It is entirely automatic.

The common practice of supplying direct-current motor-operated cranes with a dynamic lowering control means that the hoist motor must retard the load in the downward direction when the load is heavy enough to overcome the frictional resistance of the drive. With a light load or no load, the hoist motor must drive the hook downward.

Since the average load handled by most industrial cranes is only about one-third of their capacity, the Harnischfeger Corporation decided to provide a means for lowering at greater speeds that would more nearly equal light-load hoisting speeds. The device that was developed is controlled only by the weight of the load itself. When the load is heavier than about one-third the crane capacity, the relay automatically prevents the speed increase.

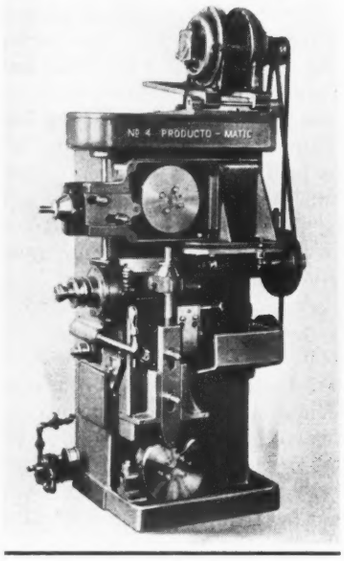
Producto-Matic Thread and Cam Milling Machine

A machine of vertical construction intended for thread and cam milling operations has recently been added to the line of Producto-Matics built by the Producto Machine Co., Bridgeport, Conn. Conservation of floor space and accessibility are the advantages claimed for the vertical construction. The machine has two main movements—a vertical travel of the work-slide and a lateral travel of the cutter-slide. Separate cams operate the two slides.

In thread milling operations, the work-slide is operated to carry the work to the cutters and to withdraw the slide for reloading. The cutter-slide moves laterally to provide the desired lead in the thread being cut. This lead is secured by a generating movement of the cam, which is said to be a new departure in thread milling.

Multiple-point cutters can be used to complete the thread in one revolution of the work-spindle. When single-point cutters are used, the work-spindle makes the same number of cycles as there are threads. The depth of thread is accurately controlled by means of a micrometer adjustment. The cutter-spindle bearing can be swiveled 12 degrees to the right or left for obtaining the cutting angle that is required. An automatic chucking mechanism can be supplied.

In milling cams or other parts of irregular contour, the work-slide is actuated vertically by a master cam. End-mills, plain milling cutters, or special cutters can be used. The lateral movement of the cutter-slide is utilized in milling path-type cams. Various rates of automatic feed are available for both the cutter- and work-slides by ratchet feed mechanisms. The base of this machine measures only 30 by 24 inches. The machine is 54 inches high.



Vertical Producto-Matic for Thread and Cam Milling Operations

Carboloy General-Purpose Milling Cutter

A face-milling cutter provided with Carboloy-tipped blades has been developed by the Carboloy Company, Inc., 2487 E. Grand Blvd., Detroit, Mich., for universal application on cast iron, non-ferrous metals, and non-metallic materials. This cutter is 5 inches in diameter.

Heretofore, the economical use of Carboloy milling cutters has been confined mainly to quantity-production jobs. The new cutter has been developed for economical use on short-run diversified milling jobs, the standard cutter being suitable for interchangeable application in the same manner as a high-speed steel cutter. The new cutter, however, is not intended to replace special Carboloy cutters on quantity-production jobs.

To make the general-purpose cutter practical for many kinds of materials and parts, modified designs are employed that give economical results without the sensational increases in speeds, etc., that are common to Carboloy milling. The advantages of cemented-carbide milling are, however, said to be obtained with the general-purpose cutter to an extent that permits a substantial saving. Among these advantages are high accuracy, improved finish, and long cutting life between grinds. In addition, this cutter provides a means of milling hard materials and of combining roughing and finishing cuts.

Carboloy Milling Cutter for Diversified Small Runs of Work

Nelson Section Liner

Accurately spaced cross-section lines can be easily made on drawings through the use of an inexpensive device that is being placed on the market by the Nelson Section Liner, 727 N. Seventh St., DeKalb, Ill.

This section liner consists of a piece of laminated Bakelite with two series of steps along the upper edge. It is intended that the bottom edge of the section liner be held against a T-square and that a triangle be positioned on two steps at opposite ends of the upper edge. Then, by alternately moving the triangle and the section liner an amount definitely controlled by the difference in length between the triangle leg and the shoulders of the steps on which the leg rests, section lines can be accurately spaced on a drawing.

Hutto Connecting-Rod Honing Equipment

Hones, fixtures, and machines designed for the precision finishing of automotive connecting-rod bores individually to serve as seats for steel-backed babbitt bearings are a recent development of the Hutto Engineering Co., Inc., 515 Lycaste Ave., Detroit, Mich. It is claimed that the practice of honing the rods individually permits adherence to very close tolerances for straightness, roundness, and size, with minimum abrasive wear. Lack of squareness between the connecting-rod faces and the normal axis of the bore does not affect the accuracy of the finished bore. The "floating" action of the stone-holders permits a universal motion of the abrasives in relation to the axis of the rod bore, thus assuring cleaning up of the entire bore surface, even though a very small amount of stock is removed from the bore. Discrepancies of each bore are corrected individually.

The hones can be equipped either with the Hutto automatic drive-head or with the Hutto micrometer set-and-stop type of drive-head. With the former style, the hone expands and contracts automatically as it enters and leaves the crankpin bore of the connecting-rod. When either style of drive-head is used, one major setting of the micrometer adjustment is sufficient for honing a number of bores to a given diameter. In the case of the automatic drive-head, only occasional manual adjustment is required to compensate for wear of the abrasive members.

Fig. 2 shows a connecting-rod locating and holding fixture so designed that the rod does not become distorted in any manner through excessive clamping pressure. The connecting-rod is laid on plate *A* with the crankpin bore over the pilot-pin *B*. The wrist-pin hole of the connecting-rod is located over a flattened pin *C* that carries the torque of the hone during the honing operation and thus relieves the clamping mechanism of this function. When table *E* is raised by a downward pull of lever *D*, the connecting-rod is gripped lightly but securely between plate *A* and clamping points on the lower end of the bushing *F*. As the lever is moved still farther, table *E* and bushing *F*, with the work piece between them, move upward together.

Pilot-pin *B* is automatically withdrawn from the work at a point intermediate between the lower and upper extremities of the table travel. Then the hone, previously contracted by pressure exerted on the pawls of the automatic head as bushing *F* passes over them, is entered into the connecting-rod bore. When the hone has reached a predetermined point in the bore, the pressure on the pawls is released so that the hone can expand to the size of the bore.

As the hone is rotated and reciprocated by the machine, it removes the required amount of stock from the connecting-rod bore, the hone automatically expanding until it reaches the diameter for which it is set. Continued operation of the tool beyond this point serves only to impart a higher luster to the bore than is normally produced.

Upon completion of the honing operation, the fixture is lowered by moving lever *D* upward. As the fixture travels downward, the pawls in the automatic head of the honing tool are again depressed to contract the abrasive stones of the hone. With this arrangement, the connecting-rod leaves the hone without the bore becoming scratched or otherwise marred.

The simple and easily operated fixture illustrated is only one of many types which may be adapted to this work. The pilot pin, plate, holding sleeve and guide bushing of the fixture can be made interchangeable for various sizes of connecting-rods.

Fig. 1. Hutto Automatic Honing Tool

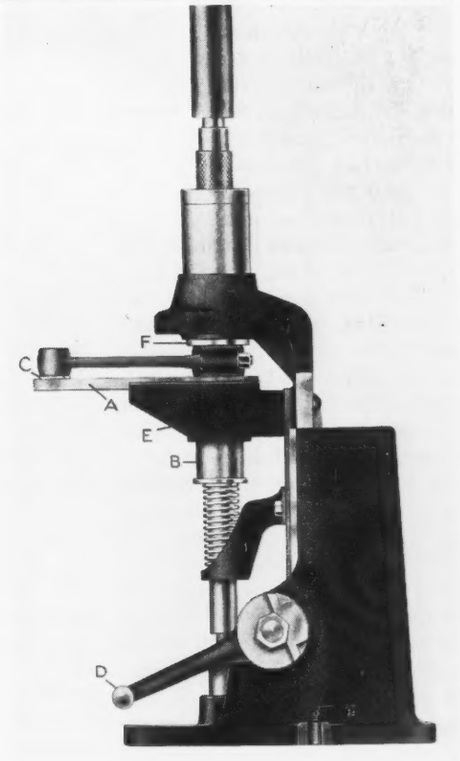
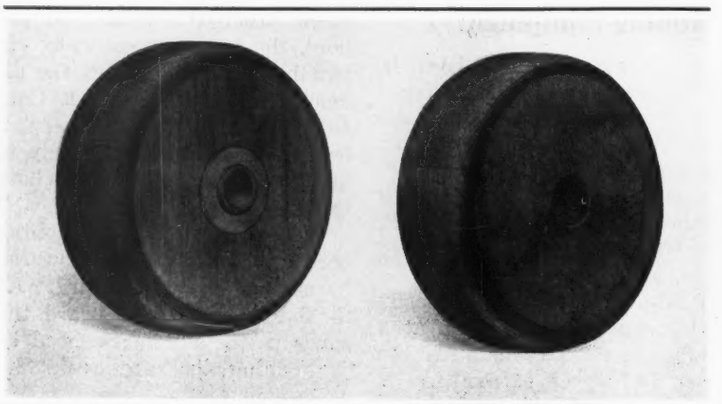


Fig. 2. Fixture Designed for the Individual Honing of Connecting-rod Bores



Light-duty End-wood Truck Wheels with Floor-saving Treads

Light-Duty End-Wood Truck and Caster Wheels

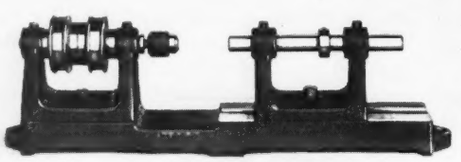
End-wood protective-tread wheels and casters for regular-duty, heavy-duty, and super-strength service have been made for years by the Metzgar Co., Inc., Grand Rapids, Mich. This line has now been supplemented by a wheel intended specifically for light-duty applications. This wheel is manufactured in diameters from 2 1/2 to 10 inches, inclusive. Any face thickness or hub length can be provided, and the bore diameter can be made to suit the axle. Either an oilless end-wood bearing can be provided, as shown at the right in the illustration, or a ball bearing, as illustrated at the left.

As is the case with the other end-wood wheels made by this concern, the light-duty style is built up of a number of wedges cut from selected hard northern maple. The wheels are constructed without the use of rivets or other metal pieces by employing a water- and weather-proof glue. Advantages claimed for all wheels of this line are that they reduce the wear and tear on floors, and have easy-rolling, shock-absorbing, and long-wearing qualities.

The light-duty wheels are rated 25 per cent below the regular-duty in strength, but the non-abrasive properties are equal.

Langelier Horizontal Bench Tapping Machine

A bench tapping machine of improved design, which is intended for light operations on optical, radio, electrical, jewelry, and other small parts, is being introduced on the market by the Langelier Mfg. Co., Providence, R. I. The spindle of this machine is equipped with a No. 1 Jacobs chuck, the machine having a capacity for tapping holes up to 3/16 inch in sheet metals.



Langelier Bench Tapping Machine for Small Parts

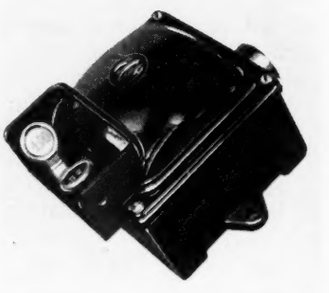
The tapping spindle is driven by open and crossed belts and a friction clutch. The spindle runs in a bronze sleeve on which the pulleys are mounted, the construction eliminating any belt pull on the spindle, permitting it to float, and enabling the direction of rotation to be changed with ease.

The tailstock is equipped with a shaft having a tapered socket, so that fixtures can be used to align the work with the tap. The distance from the bed to the center of the spindle is 3 1/4 inches. The bench space required is 22 by 4 inches.

Push-Button for Remote Control

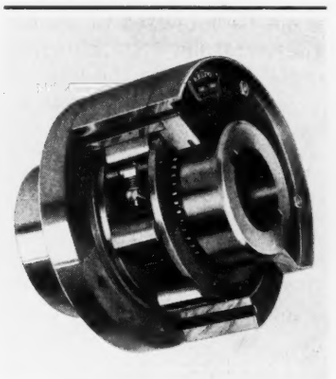
The Electric Controller & Mfg. Co., 2705 E. 79th St., Cleveland, Ohio, has brought out a push-button for installations where it is desired to start and stop a motor through a magnetically operated starter or controller from two or more push-button stations, at any one of which it may be desired to lock the push-button in the "off" position.

Typical applications include large machine tools, grain elevator conveyors, and coal-, stone-, or other material-handling systems. In such applications, it is frequently desirable to control the starting and stopping of a motor from any one of a number of push-button stations, and for reasons of safety, to give preference to all stop buttons over any start button. In such cases, the insertion of a padlock on the stop side of one of the push-buttons will prevent operation of the motor-driven equipment until the authorized person has removed the padlock and re-established the control circuit. This push-button is enclosed in a dust-tight and vapor-proof enclosure that insures safe operation.



Safety Lock-out Push-button

Osgood Stock Chest for Handles and "Filegrips"

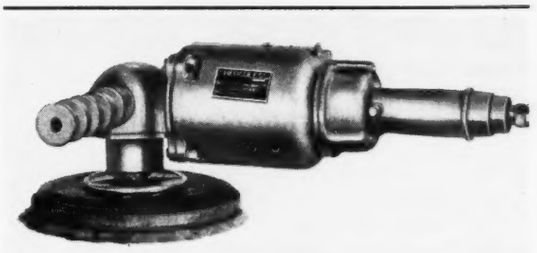


Morse-Kelpo Clutch that is Free Wheeling in One Direction

Osgood Stock Chest for Handles and "Filegrips"

Stock chests for file and tool handles and safety "filegrips" are being placed on the market by the J. L. Osgood Machinery & Tool Co., Inc., 43-45 Pearl St., Buffalo, N. Y. As may be seen in the illustration, this chest is made with seven compartments, proportioned to accommodate the average number of handles of various sizes used. Six compartments are for Nos. 0 to 5 handles and the other for "filegrips."

The chest is 16 inches high, 21 inches wide, and 24 inches long. It is made of heavy fiber board, and is fitted with a hinged cover. The chest may be supplied filled with handles and "filegrips" or partly filled.



High-frequency Portable Electric Tool Designed for Polishing and Sanding

Hercules High-Frequency Portable Electric Tools

The Buckeye Portable Tool Co., Dayton, Ohio, has recently developed a polishing and rubbing tool and a sander that are identical in construction, except that the first-mentioned tool is provided with an 8- or 9-inch rubbing pad, while the sander is equipped with an abrasive disk or a cup emery wheel. When used for polishing and rubbing, the speed of the tool is 1800 revolutions per minute, and for sanding, 4700 revolutions per minute.

These tools are driven by a Hercules high-frequency motor which is of cool-running design. In addition, the handles are insulated from the body of the tool. An insulating pad which supports the stator can be replaced without discarding the housing.

Morse-Kelpo Clutch with Free-Wheeling Feature

The Morse Chain Co., Ithaca, N. Y., Division of the Borg-Warner Corporation, is placing on the market a positively actuated one-way clutch that is free wheeling in one direction but drives in the other. Since this clutch operates without backlash, it is particularly suitable for ratchet drives.

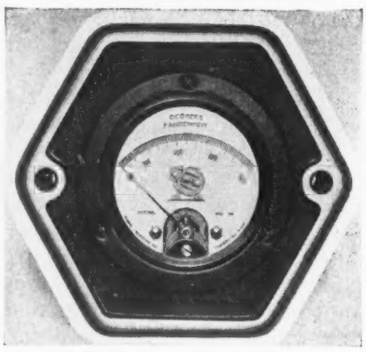
When it is used to connect two prime movers to a common load, either one will pull the load, but neither can drive the other. Two motors are sometimes used in such a combination or a motor and turbine. Another application for the clutch is in booster drives used for starting heavy machines, such as printing presses, paper mills, and steel mills. The clutch is made of alloy steel and is hardened and ground. One of its features is automatic compensation for wear.

Baldor "Flex-Align" Coupling

A flexible coupling that is self-aligning, vibration-absorbing and universally flexible has been placed on the market by the Baldor Electric Co., 4351-59 Duncan Ave., St. Louis, Mo., under the trade name of "Flex-Align." This coupling is designed to take care of large amounts of misalignment, both lateral and angular, and to insure uniform rotation. The driving members are made of a rubberized fabric that is resilient. With this coupling, a motor can be located unusually close to the driven unit.

The coupling will run in either direction without backlash. It is made in three sizes, of 1/3, 1, and 3 horsepower ratings at 1725 revolutions per minute.

Baldor "Flex-Align" Coupling



"Hold-Heet" Pyrometer Available for Many Applications

"Hold-Heet" Pyrometer for Many Applications

The Russell Electric Co., 354 W. Huron St., Chicago, Ill., has brought out a low-priced pyrometer suitable for use on a wide variety of equipment, including heat-treating furnaces, die-casting machines, plastic molding machines, soldering machines, cyanide and other hardening baths, and japanning ovens. This pyrometer has been given the trade name of "Hold-Heet." It is made in two styles having ranges of from 60 to 800 degrees F. and from 60 to 1600 degrees F.

The pyrometer is especially designed to be supplied as a standard device by the manufacturers of equipment such as mentioned. It is intended that the pyrometer be permanently mounted on the machine in a position where it will not be subjected to the heat of the operation. Extension leads may be attached to the top, bottom, or sides of the hexagonal case.

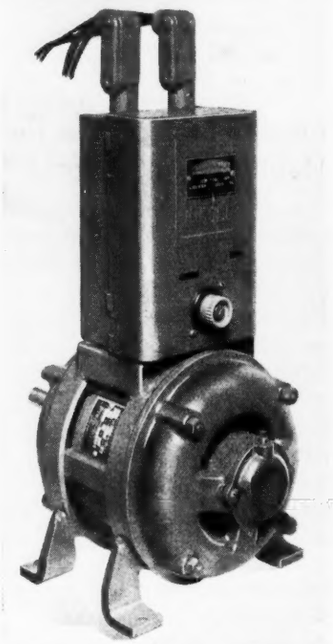
CP External Tube-End Polisher

The rotary-driven pneumatic tool made by the Chicago Pneumatic Tool Co., 6 E. 44th St., New York City, for polishing the ends of boiler tubes externally, which was described in the technical press some months ago, is now made in three sizes. These sizes have a capacity for tubes from 2 1/4 to 3 inches, 3 to 4 inches, and 3 3/4 to 4 1/2 inches outside diameter. The tool is equipped with Carborundum sticks that can be readily replaced when worn. A light-weight heavy-duty motor drives the device. The closed handle is equipped with a safety throttle.

Motor Protected Against Burning Out

An induction motor that has a protective device built into the windings that prevents burning out is a recent development of the Lincoln Electric Co., Cleveland, Ohio. This device shuts off the current if the motor is stalled through overloading, if it becomes excessively hot due to poor ventilation, or if it is run on single-phase current. The advantages claimed are that less supervision is necessary, that repair bills are reduced, and that smaller sized motors can frequently be used. At peak loads, the protector automatically disconnects the motor.

This motor is built in sizes from 1/2 to 30 horsepower, for either two- or three-phase current of standard commercial cycles and voltages.



Lincoln Motor with Protective Device Built into the Windings

Discriminatory Taxes Considered a Hindrance to Recovery

The National Automobile Chamber of Commerce has filed with the Senate Finance Committee a brief opposing the continuance of discriminatory federal taxes on automobiles and automotive products, including gasoline, because these taxes are considered an impediment to the efforts of the motor industry to hasten business recovery.

"Code compliance, with increased wages and higher material costs, plus the maintenance of the federal excise taxes," says the brief, "means cancelling any cost reduction achieved through engineering and manufacturing progress. The industry is thereby unable to realize the benefits from widened markets which should be available through its consistent efforts to reduce the cost of its product to the consumer."

The brief particularly emphasizes the following points: (1) Tax discrimination against specific industries is unfair; (2) automotive taxes are a tax upon a necessity; (3) federal excise taxes bear most heavily upon consumers in the small income class.

One further step might well be taken by the Automobile Chamber of Commerce. Taxes are necessary. The suggestion of methods of taxation that are not discriminatory to industry or business would be a worthwhile service.

NEWS OF THE INDUSTRY

Illinois

EYVIND W. PETERSEN, Cunningham Road, Rockford, Ill., has been appointed representative of the St. John X-Ray Service, Inc., 30 Thomson Ave., Long Island City, N. Y., in the Chicago-Milwaukee district. Mr. Petersen was connected for many years with the Doehler Die Casting Co., and for the last eleven years has been metallurgical engineer for Fairbanks, Morse & Co. of Beloit, Wis. He is now serving as consultant to the non-ferrous foundry trade.

HAROLD W. FAINT has joined the sales engineering staff of the Udylite Process Co., Detroit, Mich. Mr. Faint's headquarters will be at Chicago. He has had a wide experience in the electroplating industry, and previous to his present connection, was associated with the Crowe Name Plate & Mfg. Co., of Chicago, as chemical engineer in charge of special metallurgical and finishing problems.

W. I. BROCKSON has severed his connection of ten years' duration as advertising manager of the Steel Sales Corporation, Chicago, Ill., and has become associated with the Commercial Advertising Agency, 440 S. Dearborn St., Chicago. Mr. Brockson is a past-president of the Engineering Advertisers' Association and is a frequent contributor to trade magazines.

Michigan and Wisconsin

BUNDY TUBING CO., 10951 Hern Ave., Detroit, Mich., manufacturer of hydrogen-welded steel tubing, announces the organization of a subsidiary company known as H. W. BUNDY, INC. The officers of the new company are: President, W. W. Anderson; vice-president, T. M. Tude; secretary and treasurer, A. C. Winger; and superintendent, H. J. Blair. The new company will take over the commercial parts copper-hydrogen-electric-welding production of the parent company other than tubing. The general offices of the subsidiary will be at the parent company's headquarters.

PATTERSON FOUNDRY & MACHINE CO., East Liverpool, Ohio, manufacturer of pulverizing, grinding, mixing, and processing machinery, announces the opening of an office at Room 406, Basso Bldg., 7338 Woodward Ave., Detroit, Mich. EDWIN L. GRIMES has been appointed district manager at Detroit. LOUIS A. BURKHART, JR., will handle the sales in northern New York state and western Pennsylvania, making his headquarters at Corry, Pa.

RALPH G. CAULLEY has joined the Detroit district sales office of the Republic Steel Corporation, Youngstown, Ohio. Mr. Caulley had been connected with the Wheeling Steel Corporation for fourteen years, the last seven of which were spent in the Detroit district.

CHAIN BELT CO., Milwaukee, Wis., has recently completed the transfer to Milwaukee of all the manufacturing operations of its subsidiary, the Stearns Conveyor Co., of Cleveland, Ohio. The Chain Belt Co. acquired the Stearns Conveyor Co. in 1926. L. B. MCKNIGHT, formerly secretary and sales manager of the Stearns Conveyor Co., has, since the consolidation of the sales and engineering departments of the two companies in 1932, served as manager of conveyor sales for the parent company. GEORGE M. DYKE, vice-president and operating manager of the Stearns Conveyor Co., is also associated with the Chain Belt organization in an executive capacity.

New England

HERBERT A. STANTON, European manager of the Norton Co., Worcester, Mass., has just returned to his London office after a visit of several months to this country. Other members of the European organization who have recently been visiting the home office are: Michel Biscayart of Compagnie des Meules Norton, Paris, France; Otto Schutte of Deutsche Norton Gesellschaft, Wesseling, Germany; William Haddock of Norton Grinding Wheel Co., Ltd., Welwyn Garden City, England.

FARREL-BIRMINGHAM CO., INC., Ansonia, Conn., at the annual stockholders' meeting, re-elected the following officers: Chairman of the board of directors, Franklin Farrel, Jr.; president, Nelson W. Pickering; vice-presidents, David R. Bowen, Carl Hitchcock, Franklin R. Hoadley, and Armin G. Kessler; treasurer, Frederick M. Drew, Jr.; and secretary, George C. Bryant.

FORSBERG MFG. CO., Bridgeport, Conn., advises that Seth Parker, on his world cruise, is using Forsberg hacksaw frames, Whale Brand hacksaw blades, and Supergrip screwdrivers, both for use on board ship and for exhibition purposes.

New York

GENERAL ELECTRIC CO., Schenectady, N. Y., has made its annual awards on behalf of the Charles A. Coffin Foundation to thirty-two men in the company's employ. These awards are for contributions made during 1933 to the progress and prestige of the company and to the advance of the electric art. The awards were received by ten engineers, seven foremen, five shop workmen, four commercial men, three tool designers, two administrative employes, and one construction engineer. Each award consists of a certificate and a cash prize.

H. E. SEARLE, of the research department of the International Nickel Co., Inc., New York City, spoke before the North Jersey section of the American Chemical Society at Elizabeth, N. J., March 12, on the subject "Corrosion-Resistant Metals," also covering corrosion-testing procedure. The address was illustrated by a moving picture outlining the methods used at the research laboratory of the International Nickel Co.

THE PACKAGING MACHINERY MANUFACTURERS INSTITUTE held its semi-annual meeting at the Hotel Astor, New York City, March 12. The code of fair competition of the packaging machinery industry was discussed and amendments to the by-laws were presented. At the dinner following the meeting, Colonel George S. Brady, deputy administrator of the National Recovery Administration spoke on "How to Benefit Our Industry through NRA Fair Trade Practices."

J. WOODS SWEENEY has been appointed New York divisional manager of the Federated Sales Service, 537 Commonwealth Ave., Boston, Mass. Mr. Sweeney served in various sales management capacities with the New York Edison Co. for seven years. Later he was assistant manager of the New York branch of Servel, Inc., for five years. His headquarters will be at 26 Maple Hill Drive, Larchmont, N. Y.

RUSSELL, BURDSALL & WARD BOLT & NUT CO., Port Chester, N. Y., has acquired from the American Marsden Co., Jersey City, N. J., the sole manufacturing and sales rights in the United States of the Marsden lock-nut. A Marsden lock-nut division has been created at Port Chester for the development of the business. C. E. S. Place, formerly chief engineer of the American Marsden Co., is now associated with the Russell, Burdsall & Ward Bolt & Nut Co.

PETER A. BOGDANOV, chairman of the board of directors of the Amtorg Trading Corporation, 261 Fifth Ave., New York City, sailed March 16 on the steamship *Europa* for a trip to the Soviet Union, where he will confer with various officials on matters connected with the development of trade relations between the United States and the U.S.S.R.

C. F. PEASE CO., 813 N. Franklin St., Chicago, Ill., announces that FREDERICK W. BENSING has been appointed eastern sales manager of the company, in charge of the eastern sales office, which is located at 254 Fourth Ave., New York City.

Ohio

CITY MACHINE & TOOL WORKS, Dayton, Ohio, have acquired the PAULINS TOOL & ENGINEERING CO., Detroit, Mich., manufacturer of the Paulins standard drill jigs and locks, and will continue to manufacture this line under the trade name of Cimatool-Paulins. All sizes in both the positive-lock and spring-type jigs will be continued, and several new styles and sizes will be added to increase the range and adaptability of the line. Stocks will be maintained both at the factory in Dayton and at the Detroit office, 410 Stormfeltz-Loveley Building, 7310 Woodward Ave. Frank U. Paulins will remain with the Detroit office in an engineering and sales capacity.

R. A. ZILM, formerly domestic and European sales representative of the Lees-Bradner Co., Cleveland, Ohio, is now affiliated with the Cleveland Duplex Machinery Co., Inc., engaged in the sale of machine tools and special machinery. Prior to his connection with the Lees-Bradner Co., Mr. Zilm was associated with the Otis Steel Co. of Cleveland in the foundry and sales divisions.

DR. ALLAN CHESTER, formerly vice-president of the Stanford Chemical Co., New York City, and J. C. WEAVER, formerly vice-president of Weaver Bros. Co., Adrian, Mich., have joined the Ferro Enamel Corporation, Cleveland, Ohio, and will be engaged in the sale of a new electrolytic pickling machine placed on the market by that company.

G. A. BAKER, formerly manager of the Buffalo office of the Duriron Co., has been transferred to the general offices at Dayton, Ohio, where he will specialize on the sale of Durimet and Durco alloy steels. Colonel M. W. SMITH, of the general offices, has taken over temporarily the management of the Buffalo office.

The GRAY IRON FOUNDERS' SOCIETY, INC., has moved into new and larger quarters on the tenth floor of the Public Square Building, 33 Public Square, Cleveland, Ohio. From these quarters the Society will also serve the foundry industry in the administration of the gray iron industry code.

JOHN MITCHELL, of the metallurgical department of the Republic Steel Corporation, Massillon, Ohio, addressed the Indianapolis Chapter of the American Society for Metals, March 22, on the subject "Some of the Causes and Effects of Movement of Gears and Gear Steels."

ROBERT J. PARDEE, who was connected for seventeen years with the Toledo Machine Tool Co., Toledo, Ohio, and more recently with the Cleveland Punch & Shear Works Co., Cleveland, Ohio, has resigned his position.

P. J. HOPKINS, who was employed by the Cleveland Punch & Shear Works Co., Cleveland, Ohio, from 1910 to 1927, when he left to engage in business for himself, has returned to the company in a sales capacity.

Pennsylvania

EVERETT CHAPMAN, since 1930 director of engineering and research of Lukenweld, Inc., division of Lukens Steel Co., Coatesville, Pa., has been elected vice-president. Mr. Chapman was previously connected with the Lincoln Electric Co. of Cleveland, during which time he was engaged in experimental research and development.

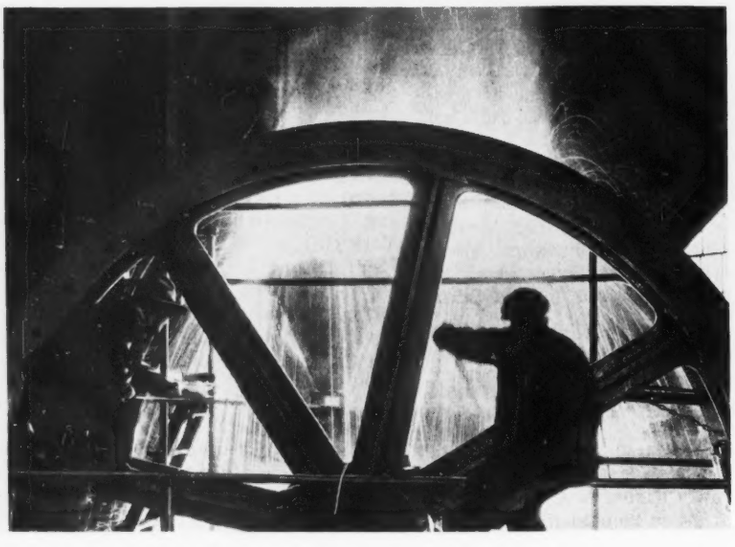
PHILADELPHIA MACHINERY DISTRIBUTORS, an association in the interest of distributors of machine tools in the Philadelphia area, has been formed with office at 1458 Broad St., Philadelphia, Pa. The officers of the Association are: President, N. P. Lloyd, Lloyd & Arms, Inc.; treasurer, J. L. Stewart, W. E. Shipley Machinery Co.; secretary, D. M. McCracken, Swind Machinery Co.

H. D. JAMES, long a consulting engineer with the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has opened an engineering-consulting service at 1532 Gulf Bldg., Pittsburgh, Pa., specializing in industrial and building problems. Mr. James is prepared to furnish technical information, assistance in purchasing where engineering questions are involved, and cost analysis, as well as to design equipment. He will have a staff of experienced engineers for special assignments, including electronic and air-conditioning applications.

Everett Chapman, Vice-President of Lukenweld, Inc.

Texas

W. B. ARBUCKLE, 1006 Washington Ave., Houston, Tex., has been appointed district representative for the Allen-Bradley Co., Milwaukee, Wis., manufacturer of electric control apparatus, including alternating- and direct-current motor starters; rheostats; battery-charging panels; relays; and a complete line of control auxiliaries.



When the main shaft drive at the power house of a San Francisco cable street railway broke at 3:30 on a Saturday afternoon, it looked as if the car lines might be tied up for weeks. To have obtained and installed a new shaft would have required that length of time; but by means of thermit-reaction welding, the shaft was repaired and in permanent running condition by 3 A. M. Monday, just about thirty-six hours after the breakdown occurred. The fractured shaft was approximately 1 foot in diameter and 18 1/2 feet long.

Machines Produce More with Good Cutters

B·S

IF A MACHINE SHUTS DOWN a half hour each day you find out why, but—do you ever question how many needless delays are caused by cutter replacements? Every time a cutter is changed, machine and operator stop producing and production is at a standstill. In an involved set-up the expense can be tremendous yet—the difference in price between the poorest and best cutters is relatively small.

Brown & Sharpe Cutters permit steady, fast production—with minimum replacement for sharpening—machines produce more with them. Use Brown & Sharpe Cutters on every job. Catalog No. 31C sent on request. Brown & Sharpe Mfg. Co., Providence, R.I., U.S.A.

Economical Cutters are Selected the "Real Cost" Way

Brown & Sharpe Cutters

MODERN — EFFICIENT — KEEP COSTS LOW

OBITUARIES

George B. Beale

George B. Beale, formerly connected with the Chicago office of the Brown & Sharpe Mfg. Co., died in Oakland, Calif., on February 24. Mr. Beale was born in Winthrop, Me., on September 27, 1857. He was a brother of Oscar J. Beale, who was well known in former days to the readers of MACHINERY as Jarno.

Mr. Beale went to Rhode Island and began work for the Brown & Sharpe Mfg. Co. in June, 1872, first in the sewing machine department, and later in the clipper department, at the time that clippers were first made. In 1882, he went to work for Cox & Prentiss, now the Cleveland Twist Drill Co., of Cleveland, Ohio, leaving there to become associated with the Hartford Pump Co., now the Sigourney Tool Co., of Hartford, Conn. In 1885, he left that company to do some experimental work on a mechanical field cotton picker for the C. T. Mason Co. of Sumter, S. C. In 1892, Mr. Beale returned to Brown & Sharpe, becoming a traveling salesman in connection with the Chicago office, and remained in their employ continuously until his retirement in 1927, when he went to live in California.

Mr. Beale was a very skillful mechanic. This fact, combined with his genial disposition and rugged honesty, gave him a unique place in the affection and regard of all of his associates, as well as of the men with whom he had occasion to do business. He went out of his way to teach innumerable young men and shop operators how to figure the problems that arise in connection with cutting gears, screws, cams, and other mechanical work, frequently arranging for them to go to his home in the evening, so as not to interfere with their working hours.

Mr. Beale's success as a salesman was based primarily on the fact that he knew his product thoroughly, and his customers realized that he would never overstate what a machine would do, but whenever he knew the limitations of a machine for the particular work in hand, he would tell the customer so frankly. He was no high-powered salesman in the modern use of the word, but because of his knowledge and integrity, his customers believed in him.

Walter D'Arcy Ryan

Walter D'Arcy Ryan, well-known illuminating engineer with the General Electric Co., died at his home in Schenectady, March 14, of heart trouble. Mr. Ryan was born April 17, 1870, at Kentville, Nova Scotia. He obtained his education in Kentville and in Halifax, possessing a pronounced mechanical and engineering talent.

Immediately upon completing his education he came to the United States, and at the age of twenty-two, obtained employment in the old Lynn Works of the Thomson-Houston Electric Co. as a student engineer. In 1896, he was promoted to the position of superintendent of test men in the West Lynn Works of the General Electric Co. In 1903, he was formally designated illuminating engineer, the first man to hold such a title, so far as is known, in the United States.

Since 1932, Mr. Ryan had been a consulting engineer of the General Electric Co. and his work was devoted to that of a consultant for the illuminating engineering laboratory. He was director of lighting at the Century of Progress Exposition in Chicago, and in fact, had been responsible for the planning and executing of every great illumination spectacle of the last quarter century

EDMUND W. ZEH, founder and president of the Zeh & Hahnemann Co., Newark, N. J., builders of power presses, died March 17 at the age of sixty-six years. Mr. Zeh was born in Germany and came to the United States in 1893. He was first employed in Buffalo, and went from there to Newark in 1904 to form his own company, which was incorporated under the present name in 1907. He designed and developed a great many different types of power presses and press safety devices. He was a member of the American Society of Mechanical Engineers and of numerous other societies and associations.

FRANK R. WHEELER, well-known mechanical engineer specializing in condenser equipment, and a frequent contributor to technical publications, died at his home, 105 E. Delaware Place, Chicago, Ill., on March 1.

Mr. Wheeler graduated from Stanford University in 1902. He was a contributor to Kent's Handbook and to Professor Gebhart's handbook on steam power plant engineering. He belonged to the American Society of Mechanical Engineers and to the Engineers' Club of New York.

GEORGE C. REILLEY, for forty years connected with the General Electric Co. and its predecessor the Edison Machine Works, died March 4 at his home in Schenectady, following a short illness. Mr. Reilley was born in Schenectady sixty-three years ago and had always made his home there. At the time of his death he was supervisor of small tools and gages with the General Electric Co. He was an authority on small tools.

MARCUS CHASE, former sales manager of the Niles-Bement-Pond Co. of Massachusetts, died March 16 at the age of sixty-two, in Belmont, Mass. Mr. Chase entered the employ of the Niles-Bement-Pond Co. in 1898, and was appointed manager in 1912, which position he held until his retirement in 1928.

NEW BOOKS

INDUSTRIAL RADIOGRAPHY. By Ancel St. John and Herbert R. Isenburger. 232 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, $3.50, net.

According to the foreword, the purpose of this book is to present the practical aspects of industrial radiography in language that can be understood by students and laymen, as well as engineers, who desire to understand the basic theories involved in this method of nondestructive testing and examination of materials for industrial purposes. It is believed that the range and usefulness of industrial radiography will be extended as more designers and users realize its possibilities. Following a brief historical outline of the early years of radiography and its present status, the book discusses the nature and properties of X-rays; influence of matter on X-rays and influence of X-rays on matter; the production of X-rays; installation for industrial radiography; the making of a radiograph; photographic procedure; interpreting radiographs; and radiography of different classes of work. Operating and cost data are given.

DARDELET THREAD HANDBOOK. 220 pages, 4½ by 7 inches. Published by the Dardelet Threadlock Corporation, 120 Broadway, New York City.

This is a handbook for engineers, designers, and mechanics, containing comprehensive information relative to the Dardelet self-locking screw thread. It outlines the purpose of the thread—its theory and design. Chapters are included covering tests made on parts having this type of thread; dimensions, tolerances, and application data; the forming of external Dardelet threads; the forming of internal Dardelet threads; heat-treatment; plating; gaging and measuring; applications; and proportions and weights of bolt, nuts, and screws. The book also contains S A E steel specifications, and data on special metals for corrosion, heat, and abrasion resistance available for the manufacture of threaded fastenings.

ELECTRICAL YEAR BOOK (1934). 303 pages, 4 by 6 1/4 inches. Published by Emmott & Co., Ltd., 31 King St., W., Manchester, England. Price, 1/6, net.

This is the twenty-seventh edition of a little book containing a collection of electrical engineering notes, rules, tables, and data. In the present edition a complete rearrangement of the contents has been made which will greatly facilitate reference and systematic annual revision. Almost every aspect of electrical work that interests the industrial user of electricity is treated in detail.